

MINING HISTORY OF MOJAVE NATIONAL PRESERVE



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Cover photo. *Shaft at the Bullion Mine with cut Juniper shoring.*

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INTRODUCTION

DESCRIPTION OF PROJECT

Mojave National Preserve (MNP, or the Preserve), created in 1994 by the California Desert Protection Act, is a 1.6-million-acre component of the National Park Service located in eastern San Bernardino County (Figure 1). The Anthropological Studies Center (ASC) at Sonoma State University has been contracted by MNP to produce a Historic Resources Study (HRS) of the historic-period mining-related resources within the Preserve. In accordance with the Department of the Interior's *Cultural Resource Management Guidelines*, Release 5 (*Guidelines*; NPS 1998:25–26), the MNP General Plan (NPS 2002) calls for the development of baseline data for all aspects of cultural activity within the Preserve. The mining HRS will ultimately become one component of a larger collection of studies, the Baseline Data for the MNP, that will document all aspects of prehistoric and historic-period use and occupation within the Preserve, including but not limited to settlement, mining, ranching, transportation, and military use.

The General Plan has identified the MNP's mission regarding cultural resources to

identify, inventory, monitor, and evaluate archeological sites, historic properties, cultural landscapes, and ethnographic resources; nominate significant resources to the National Register of Historic Places; and . . . manage, protect, and preserve such listed properties in a way that will preserve their documented archeological, architectural, ethnographic, historic, or research values [NPS 2002:51].

The National Register of Historic Places (NRHP) is the nation's official list of districts, sites, buildings, structures, objects, and landscapes that are significant in American history, architecture, archaeology, engineering, and culture. The NRHP,

which is authorized under the National Historic Preservation Act of 1966 as part of a program to identify, evaluate, and protect historic and archaeological resources, is administered by the National Park Service under the National Center for Cultural Resources Stewardship and Partnership Program.

As defined in the *Guidelines*, an HRS is a narrative historical overview designed to assist managers, planners, interpreters, cultural resource specialists, and the public as a reference for the history of a specific area. Often it includes completed NRHP nomination forms for qualifying resources.

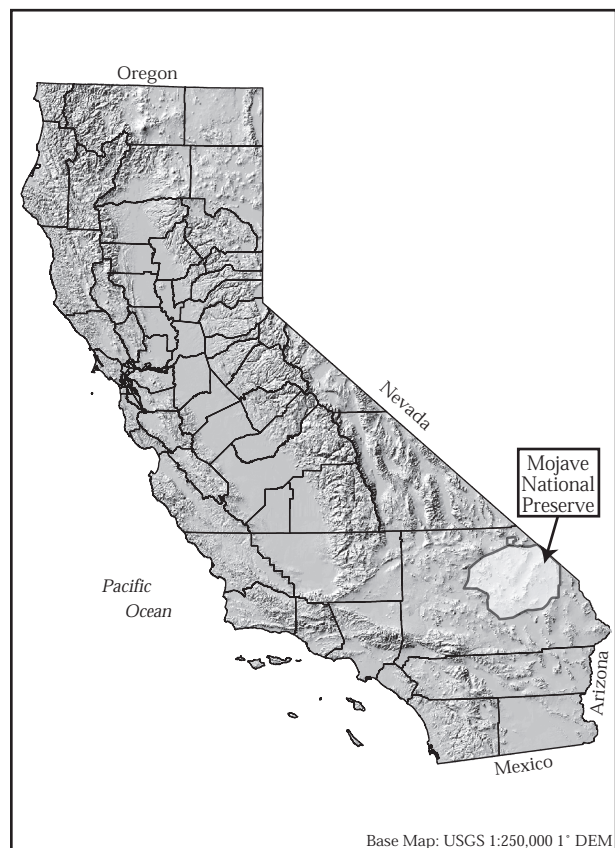


Figure 1: Location of Mojave National Preserve in California. Second only to Death Valley National Park in size, the recently established Mojave National Preserve is an immense and varied stretch of desert landscape.

While there are currently no mining resources listed on the NRHP within the Preserve, this mining HRS is designed for use in making future nominations of mining sites or districts. The HRS also identifies priorities for mining-site documentation and evaluation.

Setting

At over 20,000 square miles, San Bernardino is the largest county in the continental United States (Figure 2). The Preserve is located on the eastern side of the county, roughly between Interstate Highway 15 to the north, Interstate Highway 40 to the south, and the Nevada border to the east. Soda Springs, the Union Pacific Railroad line, and the west side of Kelso Dunes mark the general western boundary. Clark Mountain, on the north side of Interstate Highway 40, is also included in the Preserve boundaries.

The Preserve is located in a high-desert environment and is a mixture of Mojave, Sonoran, and Great Basin ecosystems (Figure 3). Elevations range from 900 to nearly 8,000 ft. above mean sea level. The area includes several diverse mountain ranges, large sand dunes, extinct volcanoes, table-top mesas, dry lake beds, and large desert valleys. Diversity is also reflected in the area's mineral deposits, where numerous and varied types of minerals exist. Gold, silver, copper, iron, lead, tin, tungsten, vanadium, manganese, rare-earth elements, limestone, cinders, clay, and salines are all located within or directly adjacent to the Preserve area. More than 1,000 plant and animal species are located within the boundaries of the Preserve, including several threatened and endangered species. A forest of Joshua trees, likely containing more than a million trees, is located on Cima Dome. Flora on the New York Mountains includes plant species normally found in coastal California. Small Rocky Mountain white-fir forests and pinyon-juniper and oak woodlands are located at higher elevations. Approximately 300 different species of wildlife have been documented in the Preserve and many more are likely to be found. Two bird and one fish species are registered on the federally

endangered list, and the desert tortoise is listed as federally threatened.

The greater Mojave Desert is bounded by the Sierra Nevada, San Gabriel, and San Bernardino mountains to the west. These mountain ranges block the westerly winds and moisture created by the Pacific Ocean, in turn creating a hot and arid desert environment on the eastern side. The Mojave Desert is bordered on the east by the Colorado Plateau. The northern boundary of the Mojave blends with the Great Basin Desert, while the southern boundaries merge with the Sonoran Desert. The Preserve is located in the southeastern intermediary zone. Rainfall varies with elevation; approximately 4 inches per year near Baker, and up to 9 inches per year in the higher elevations. Summer months are characterized by a brief monsoon; however, the majority of the rainfall occurs in late winter, with February typically being the wettest month. Average high temperatures are 90 degrees in the summer months and can exceed 105 degrees. During the winter months, temperatures can drop below freezing, occasionally bringing snow to the higher elevations.

The biotic diversity of the Preserve is matched by the variety of geologic features in the region. A string of high mountain ranges bisects the Preserve from the southwest to the northeast; beginning with the Granite Mountains in the south, the mountains progress northward to the Providence, Mid Hills, and New York ranges. Smaller ranges are located on the west and east divided by alluvial desert valleys. In the western side of the Preserve are the Kelso Sand Dunes and Devils Playground sand transport systems, which reach heights above 600 feet. Subterranean water from the Mojave River flows into Soda Lake on the western edge of the Preserve boundary. Over 200 intermittent springs and seeps are located within the Preserve as well as one perennial stream, Piute Creek. Although some springs produce potable water, most contain high mineral concentrations. East of Soda Lake is the Cinder Cone Lava Beds and Cima Dome, where the largest stand of Joshua Trees exists. On the east side of the Providence/Mid Hills/New York range is the

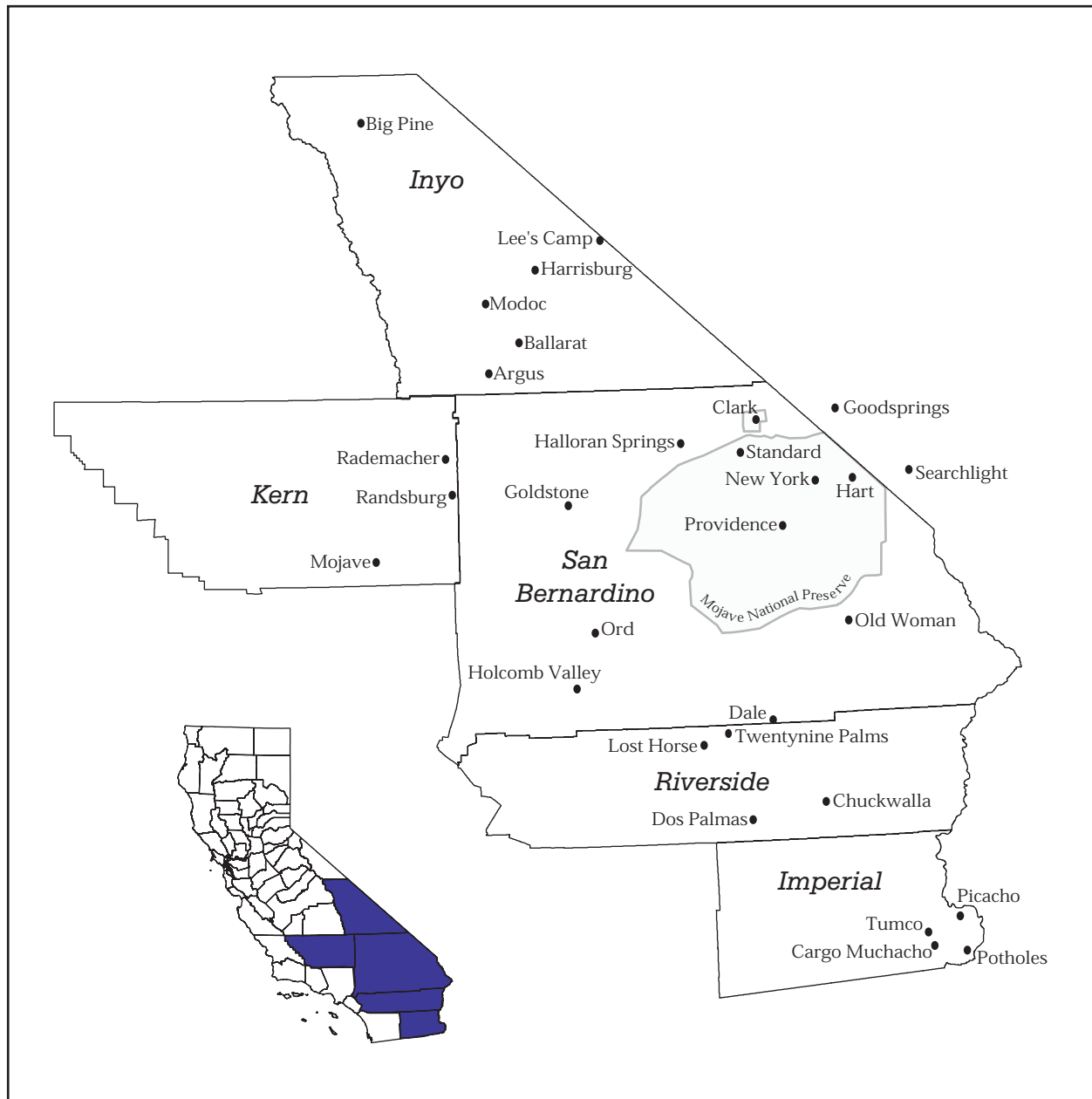


Figure 2: Historic Mining Locations in San Bernardino, Riverside, Imperial, Kern, and Inyo Counties. California's five desert counties boast thousands of mines and associated camps and towns. The mining history of the region has been overshadowed by the locations and events of the Sierra Nevada foothills to the north, yet some of the desert mining regions were the most productive in the State's history.

large Lanfair Valley, where in the early 20th century several farming and ranching communities attempted to scrape a living out of the desert. To the east of Lanfair Valley is the smaller range of the Castle Mountains and to the south are the Hackberry Mountains and the Vontrigge Hills.

Settlement

Archaeologists have outlined five periods of Native American occupation in the eastern Mojave region, defined by changes in climate, flaked-stone technology, and subsistence practices that occurred

from 5000 B.C. to A.D. 900 (Nystrom 2003). The region was a crossroads for cultures who exploited the area's resources, including "Ancestral Pueblo" people, followed by Yuman-speaking people of the lower Colorado River, and the Numic Southern Paiute. When Euroamericans first began to explore the desert, Chemehuevi and Mohave tribes traveled, hunted, and lived at various places within the Preserve area. The population occupying the Preserve was probably never more than about 150 people because of the area's limited food and water supplies.

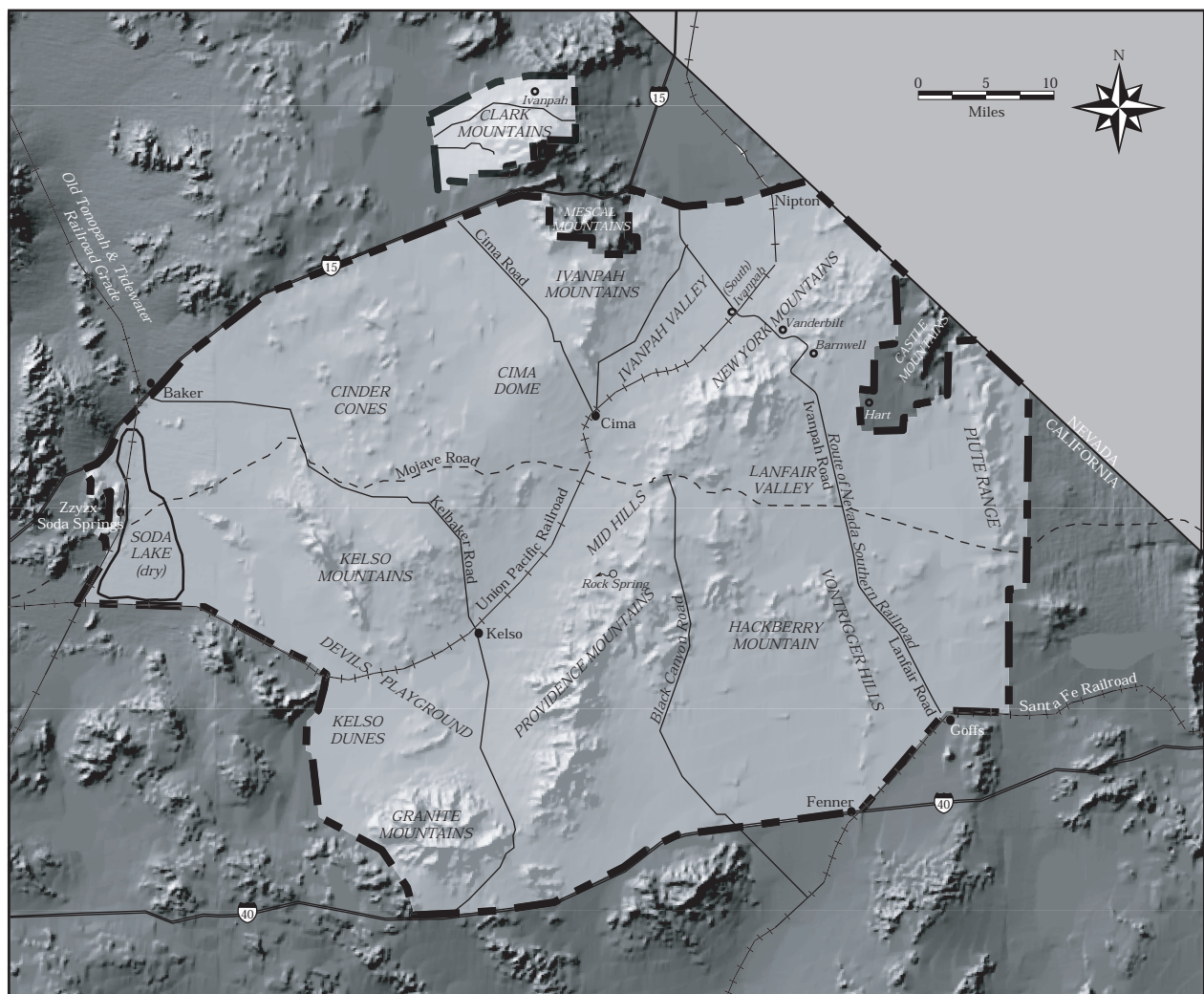


Figure 3: Mojave National Preserve: Towns, Roads, Geological Formations, and Historic Sites. Most people driving along one of the two major freeways that bound the Preserve do not realize the treasure that is located just beyond the pavement. However, the number of visitors is growing each year, over 500,000 in 2005. And given the increased traffic, resource management has become a major concern.

Following the first discovery of silver in 1863, small groups of miners became the first Euroamerican settlers within the Preserve boundaries. A few short-lived U.S. Army outposts followed, including Camp Rock Spring and Fort Pah-Ute, in order to secure the mail route and new mining areas. From the 1860s miners combed the desert ranges searching for strikes, with occasional success. Camps and towns were established near the mines, some lasting a few years and others decades, and towns such as Barnwell (Manvel) were formed as supply centers to equip numerous mining locales. Small-scale ranching grew up to support these towns by the mid-1870s. Ranching became an industry in its own right when the Rock Springs Land & Cattle Company, after its incorporation in 1894, took full control of grazing throughout the eastern Mojave. Beginning in the 1880s and continuing into the 1900s, the completion of several criss-crossing railroad lines brought jobs and people to the desert and several small towns were created to support them, including Cima and Kelso. In 1910 homesteading opened up in the eastern Mojave and families tried farming in the Lanfair Valley. People began viewing the eastern Mojave as a recreational opportunity as early as 1932, when Jack Mitchell began to lead tours through Mitchell's Caverns in the Providence Mountains. "Dr." Curtis Howe Springer, a radio evangelist and mineral-health salesman, developed the Zzyzx Mineral Springs and Health Resort on the shores of Soda Dry Lake in 1944. The U.S. military has used the Preserve area for army training, most notably General George S. Patton's Desert Training Center of World War II and "Operation Desert Strike" of 1964.



HISTORY OF MOJAVE NATIONAL PRESERVE

The events that led to the creation of Mojave National Preserve are outlined below; the summary is based on information in an Administrative History recently prepared for the Preserve (Nystrom 2003).

Whether described as "the outer edge of the wave—the meeting point between savagery and civilization" (Turner 1893), or "a condition," "a historical force", or "an anticipation" (West 1994:115), the frontier of the American West was undoubtedly a vast area to explore, exploit, and ultimately manage. For that reason, Congress established the General Land Office (GLO) in 1812 to administer all public lands within the United States. The ensuing westward expansion led to the creation of several laws to promote and assist that movement, including the Homesteading Act of 1864 and the General Mining Law of 1872. As the west became more populated and more easily accessible due to transportation improvements, there was a shift towards recognizing other values of public land, which led to the establishment of the first national park in 1872 and the creation of the system of national forests in 1905. Mineral leases and grazing rights also became important management tools. The passage of the Taylor Grazing Act and the establishment of the Grazing Service in 1934 provided up to 142,000,000 acres of public land for grazing purposes. The General Land Office and the Grazing Service jointly administered public lands until 1946, when the Bureau of Land Management (BLM) was established, incorporating both departments. Public land in the area now known as the Preserve was managed by the BLM as the East Mojave National Scenic Area. Currently the BLM is responsible for managing 262 million acres of public land within the contiguous United States and Alaska.

Mojave National Preserve was established with the passage of the California Desert Protection Act on 31 October 1994. The total acreage of the Preserve, including private in-holdings, is 1,589,165 acres, with approximately 50 percent designated as wilderness. The transition from BLM land to

national preserve was complex and sometimes difficult, and is thoroughly discussed by Nystrom (2003).

A map of non-federal in-holdings within the boundaries of the Preserve looks like a large checkerboard and includes many owners and interests. For example, the California Department of Fish and Game owns 139 acres near Piute Spring on the eastern side of the Preserve. Providence Mountains State Recreation Area is owned and operated by the State of California and encompasses approximately 5,200 acres. The Regents of the University of California own 2,200 acres of land in the Granite Mountains, designated as the Granite Mountains Natural Reserve. State school land accounts for 35,398 acres and the Union Pacific Railroad owns 1,366 acres (NPS 2002:211–212).

Additionally, 4.7% of the land within the Preserve boundaries is privately owned. In the current year, approximately 75,000 acres of land was private, mostly within Lanfair Valley (Figure 4). Homesteaders attempting rain-fed agriculture in the early 1920s acquired much of that land, typically in small parcels. Remnant towns exist within the Preserve, including Cima and Kelso, both related to

the Union Pacific Railroad. Cima continues to operate a post office and a store. Nipton, Goffs, Fenner, and Baker are located just outside the Preserve boundaries. Many settlements have been abandoned to become ghost towns, including Barnwell (Manvel), Lanfair, Hart, Vanderbilt, Ivanpah, and others.

There are also several thousand acres of mining claims within the Preserve. Between 1863 and 1994, approximately 17,000 claims were staked. When the Preserve was established in 1994, approximately 2,500 claims were still “active,” meaning the paperwork and annual fees had been recorded with the BLM. By 2006 MNP had reduced the number to 432, based on decisions regarding validity work by certified mineral examiners, on failure of the claimants to meet all the legal requirements for maintaining a claim, and through abandonment by the claimants (Weasma 2006, pers. comm.). Only 87 claims, totaling approximately 1,350 acres, are patented, indicating that owners have met the federal requirements to acquire title to the land. The California Desert Protection Act and the establishment of the Preserve mandated that no new mining claims could be located and then patented. Mining can occur on claims that have passed a validity examination by meeting all the legal requirements established prior to the creation of the Preserve. A mining plan and a separate environmental impact analysis must first be approved, a complicated and nearly insurmountable hurdle due to the government’s strict regulations for operating mines within public parkland (NPS 2000:212; Nystrom 2003). Furthermore, although the any patent issued after the enactment of the California Desert Protection Act patents only the minerals and the right to mine; the land remains in federal ownership (Weasma 2006, pers. comm.).

At the present time, tourists, recreationalists, and adventure seekers regularly visit the Preserve. Rock-climbing, hunting, hiking, bicycling, four-wheel drive touring, and camping are all popular activities. Two research and educational facilities are located within its boundaries: the University of California operates the Sweeney Granite Mountains

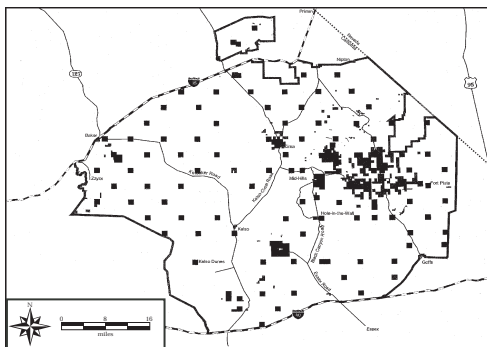


Figure 4: Private In-holdings. *The creation of the Mojave National Preserve had rocky beginnings, partly due to the great amount of private in-holdings located within the proposed area. Local residents and park officials are working together to construct a situation that satisfies everyone who cherishes the eastern Mojave (adapted from NPS 2002).*

Desert Research Center and California State University runs the Soda Springs/Zzyzx Desert Studies Center.

MINING RESEARCH IN MOJAVE NATIONAL PRESERVE

Several individuals have made massive contributions in terms of both time and resources to the history of mining in the greater California Desert area, including the eastern Mojave. Without their efforts, this current study would have not been possible. The vast land base, rich geological resources, and more than a century and a half of mining activity have generated a history that is vast and detailed. Primary source documents are numerous, especially mining items in several historic-period southern California and Nevada newspapers. Compilation of those articles—along with photographs, mining-claim information, and other sources—has been a significant element in piecing together the history of mining in this remote and often misunderstood region. Larry Vredenburg has been paramount in this effort. His research on mining in San Bernardino and Riverside counties for the five-county study entitled *Desert Fever: An Overview of Mining in the California Desert Conservation Area* is the most complete documentation of mining activity in the California Desert area. The report was written by Vredenburg and co-authors Gary L. Shumway and Russell Hartill, and was produced for the Desert Planning Staff of the Bureau of Land Management in 1980 and later published by Living West Press as a limited edition under the same title.

Continuing in his efforts, Vredenburg teamed up with Alan Hensher in 1987 to produce *Ghost Towns of the Upper Mojave Desert*. Originally published by Hensher in 1979 as *Ghost Towns of the Central Mojave*, the updated research report includes descriptions of towns and mining camps located in the California Desert, including the area of the Preserve, as well as details about the nearby mines that stimulated the creation of those settlements.

Both researchers have been steadily active in the dissemination of the history of mining in the California Desert. Vredenburg has created an internet Web site that includes articles from both reports as well as new research accessible at <http://vredenburg.org/mining_history>.

Prior to the work of the researchers mentioned above, the Desert Planning Staff of the Bureau of Land Management contracted *Background to Historic and Prehistoric Resources of the East Mojave Desert Region* (King and Casebier 1981). Dennis Casebier wrote the historic-period overview. His annotated bibliography is extremely well organized and supportive for research on all aspects of history and life in the eastern Mojave. Casebier is one of the foremost authorities on the general history of the eastern Mojave Desert and has written many books, most of them published by the Tales of the Mojave Road Publishing Company. He has also assembled an extensive collection of Mojave Desert primary and secondary documents, photographs, maps, and oral interviews. The Mojave Desert Heritage and Cultural Association, an organization founded by Casebier, has received funding from the California Cultural Endowment to create a research center in the Goffs Schoolhouse, itself listed on the NRHP.

Formerly with the San Bernardino County Museum Association, Robert E. Reynolds has also been active in studying and assembling other research on historic mining in San Bernardino County. He has edited several volumes pertaining to mining, geology, and history of the eastern Mojave Desert, including the Preserve area. He also recorded and evaluated mining-related resources at the Colosseum Mine in the Clark Mountains.

In 1990 the U.S. Bureau of Mines documented all known mineral sources within the Preserve area. That report, entitled *Minerals in the East Mojave National Scenic Area, California: A Minerals Investigation*, identified 701 mine sites and prospects. Previously, fewer than 300 sites had been recognized. Each mine or prospect description was given a Preliminary Site Investigation (PSI) number that correlates to a general map, the mine name if known, a U.S. Bureau of Mines Mineral Industry

Location System number (MILS), a geologic summary, a short summary on workings and production, and a sample rock analysis. The study estimated that, at 1990 prices, the total value of identified mineral resources within the Preserve was \$7.7 billion.

Following the establishment of the Preserve, NPS hired Ted Weasma and Gordon Pine to assess the validity of mining claims within the Preserve as well as Joshua Tree and Death Valley National Parks. Weasma, lead geologist/validity examiner, has been instrumental in compiling historical information and references pertaining to mining activity within the Preserve. His research has often led him into historical documents, including mining claims and district records.

Weasma and Pine, assisted by David Moore (GIS Specialist), located, documented, and photographed mining-related features and historic structures (many mining-related) within the Preserve. Using the 1990 U.S. Bureau of Mines report as a guide, the team updated information for the mining sites within the Preserve, and found and documented an additional 50 previously unrecorded mining sites. Each location was recorded with a GPS unit and the features were briefly described and photographed. All of the information was used to create a database that includes the name and location of the mine site and feature types and descriptions (Weasma 2005b; 2005c).

ORGANIZATION OF THIS REPORT

To help set the stage for the mining history of the Mojave Desert, this historical overview begins with a brief introduction of precontact Native American transportation routes within the Preserve boundaries, leading up through the time of Spanish and early American explorations. Then, to provide context for mining within the Preserve area, the greater California Gold Rush is discussed, along with its effects on social organization, technology, and people. This is followed by a historical overview of mining activity within the Preserve and adjacent areas; the events are organized under key themes to help in future site evaluation. Finally, the report details archaeological property types found at mining sites in the Preserve. Known information about recorded and evaluated mining sites within and adjacent to the Preserve is presented, offering suggestions for continued research on mining-related sites. Three appendices follow the report. Appendix A is a list of mining sites given state-designated trinomials from the San Bernardino Archaeological Information Center. Appendix B details 40 important mining sites in the Preserve. Appendix C is provided on CD-ROM and contains geospatial data on mining and mining-related sites in the Preserve as well as detailed site-specific information.

FRAMEWORK FOR MINING HISTORY IN MOJAVE NATIONAL PRESERVE

The boundaries of the Preserve are a modern, artificial construct. Mining activities did not occur solely in the area now called the Preserve; there were and still are active mining areas throughout the greater southern California and Nevada desert lands. Some mining districts were located completely within the area of the Preserve, but some also extended outside of the boundaries or were located immediately adjacent. In general, the Preserve area had a few short-lived and productive mining areas, but many successful mining locations in San Bernardino County were outside of the Preserve, including the Bagdad area east of Ludlow, the Halloran Hills and Silurian Mountains northeast of Baker, the Calico District east of Barstow, and the Dale Mining District in southern San Bernardino County near Twentynine Palms. The framework outlined below was created exclusively for the mining history within the Preserve, but it is important to remember that mining activities were a part of the general mining landscape that extends beyond Preserve boundaries.

PREVIOUS FRAMEWORKS DEVELOPED FOR MINING IN THE EASTERN MOJAVE

VerPlanck (1961) outlines three distinct phases of mining in northeastern San Bernardino County. The first phase includes discovery and operations that began in the early 1860s and continued into the 1890s. Then began the second, very productive phase, which continued into the next century and climaxed during World War I. The third phase was a general decline in mining following World War I, with briefly lived bursts of activity during the depression years and World War II. Finally, VerPlanck predicted the future of mining in the area, including the extraction of large tonnage, low-value ores located far from industrial centers.

Shumway, Vredenburg, and Hartill (1980) developed a chronology for mining in the California

desert that is divided according to decade. This scheme includes mining activities in five California desert counties and therefore has a broader perspective, but also applies to mining in the eastern Mojave Desert and the Preserve area. Their breakdown begins with the 1870s and 1880s, which were dominated by silver mining, with setbacks in production when national banks failed in 1873. In the 1890s miners began mining gold when the value of silver plummeted and the process of cyanidation was developed. The 1900s were characterized by increased discovery and production of gold, silver, copper, and other minerals, including borax. During World War I in the 1910s, mining continued to prosper and old waste-rock piles were reexamined for previously overlooked minerals such as tungsten, lead, zinc, and manganese. In the 1920s mining activity lessened because of inflation. The Great Depression of the 1930s resulted in a mining revival due to high unemployment and the discovery of several rich gold deposits. During World War II, Executive Order L-208 closed down nearly all non-essential mining operations and mines that produced minerals considered necessary for the war effort prospered. Gold mines throughout the desert were abandoned, with most never able to recover after the war. Mining in the 1950s included the search for uranium and “exotic” (rare-earth) minerals.

NEW FRAMEWORK FOR MINING IN THE PRESERVE

Incorporating these models, a four-phase framework has been developed that defines the mining history in the Preserve. The four historic contexts used to outline the history of mining in the Preserve are summarized below. Each context is expanded and more fully discussed in the third chapter of this document.

Silver Mining in Mojave National Preserve, 1863–1893

In 1863 during a peak period of value, prospectors discovered silver about 10 miles southwest of Rock Spring in the Mid Hills. Most mines were operated by individuals or small groups funded by outside investments. Mines generally produced a high-grade ore that miners easily obtained in small operations; it could be processed on-site using small mills or arrastras, or hauled to larger mills for further refinement. Some operations shipped ore as far as Wales for smelting. Supplies for the mines and camps were brought by ship from San Francisco to the southern California port of San Pedro, hauled by wagon to San Bernardino, and then along the Government/Mojave Road; alternatively they arrived via the Colorado River from the southeast. Burros often hauled equipment and goods the last several miles to the mines. Beginning in the 1880s, several ranches were established in the Mojave that were able to supply the miners and service people in the desert towns and camps. Low-grade deposits were discovered during this period but could not be profitably exploited with the available resources. Production fluctuated throughout the decades according to silver values, until the repeal of the Sherman Silver Act in 1893 caused an extreme drop in prices that quickly closed down many mines and drastically cut back silver production.

Golden Years of Mining in Mojave National Preserve, 1893–1929

A renewed interest in gold occurred following the silver crash of 1893. When the high-grade ore played out, new technologies such as cyanidation and improved transportation methods became necessary. Outside investment and large-scale operations became integral in the extraction of minerals from low-grade ore. The construction of several rail lines into the area eased the limited transport, and a few sizeable towns were established. When the Santa Fe Railroad completed its line from Needles on the Colorado River to the west in 1883, the New York Mountains and other areas south of the Clark District were re-examined

for their potential. Although mineral resources were located, they could not be profitably exploited until the rails were brought even closer. Completion of the line to the New York Mountains (and later Ivanpah Valley) in 1893, the Union Pacific line from Utah in 1905, the Searchlight Branch in 1907, and the Tonopah and Tidewater in 1910 completed the transportation circuit. Graded roads improved as the automobile became more widely used. New towns developed at railroad stops and the population of Lanfair Valley grew as homesteaders claimed tracts for rain-fed agriculture. Gold mining continued into the 20th century, as did the exploration and development of base metals such as copper and lead. The early 1900s were also a significant period for the exploration of oil and natural gas, although no deposits were developed within the Preserve boundaries. Limestone deposits were also explored although they were determined too distant from transportation sources to be lucrative projects. Increased production of manufactured goods required metals that were previously unexploited. The United States involvement in World War I also required new minerals for new technologies, which spurred the growth of tungsten and vanadium mining. Antimony, zinc, and manganese were located and mined just outside of Preserve boundaries.

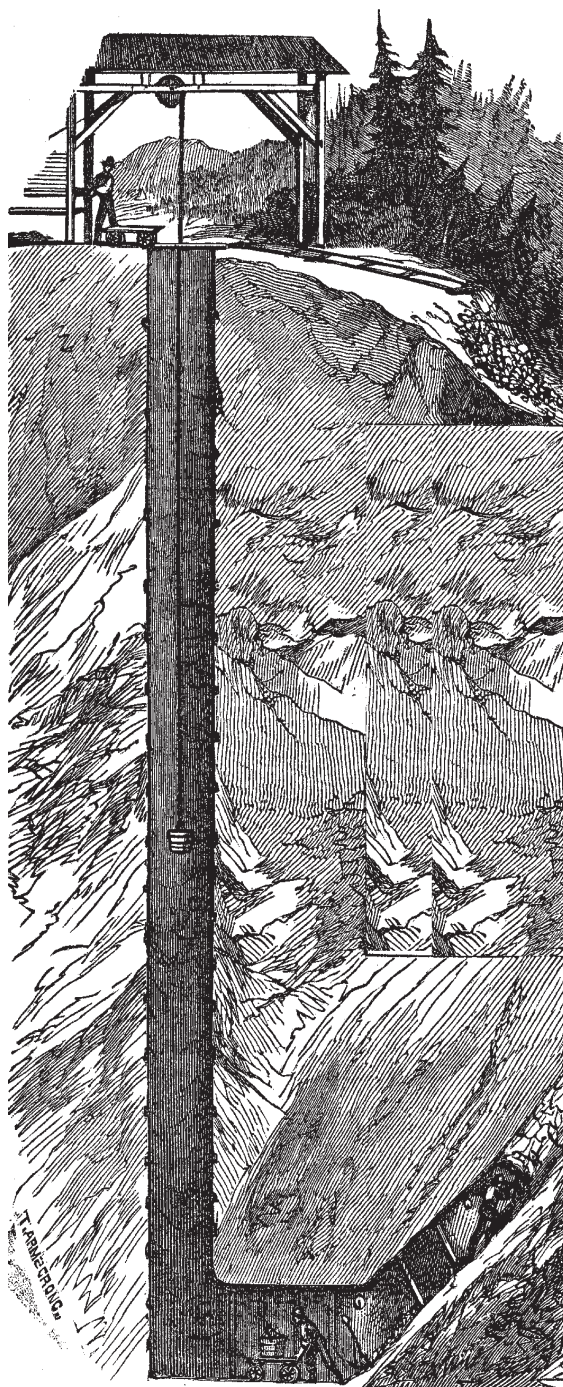
Great Depression Mining in Mojave National Preserve, 1929–1941

A decrease in manufacturing followed the end of World War I, which caused a decline in mining activity. The Great Depression in turn created such a high national unemployment that many men and their families turned to mining as a means of survival, both financially and psychologically. Low-funded organizations or families opened up mines throughout the Preserve area, often exploiting previously mined deposits. Politically created increases in gold values triggered a spike in mineral production, generating the highest output of gold since the original California Gold Rush.

Mining in Mojave National Preserve during World War II and Beyond, 1941–present

Executive order L-208 during World War II forced all non-war-related mining operations to cease. During that time, some production was carried out for iron, tungsten, and tin, and old tailing piles were reworked with newer technologies. Mining resumed in 1945 following World War II, especially for nonmetallic minerals such as clay and rare-earth minerals. The Castle Mountain clay deposits were exploited beginning in the 1920s and peaking after World War II. The large cinder deposit at Cinder Cones was developed. Surveys gas and oil were completed although with no result. Uranium was discovered in the New York Mountains as early as 1909 and the search for radioactive minerals led to the discovery of the Mountain Pass rare-earth mineral deposit just outside the Preserve boundaries. As transportation and technology improved during the second half of the 20th century, mining operations in the Preserve grew in size and scope. When the dollar was devalued and gold became a floating asset, prices began to skyrocket and several large gold-mining operations opened in the Preserve area. Large tonnage and low-grade ores were processed. The ultimate creation of the Preserve in 1994 put an end to almost all mining within its boundaries.

Several factors affected the timing and success of all western mining operations, including those in the eastern Mojave Desert region. Economic cycles, the development of corporations and new industrial business practices, government policies, technological innovations, transportation improvements, and environmental challenges were involved in shaping the development of mining throughout the desert regions of Nevada and Southern California (Barnes 2002:24). These themes are used in the following section to examine the development of mining within the region of the Preserve.



HISTORICAL BACKGROUND

THE DEVELOPMENT OF MINING IN THE MOJAVE

Human impact on the Mojave Desert began before miners started combing the desert. While Native Americans used the Preserve area for camping and hunting for thousands of years, at the time of contact the area was primarily a crossroads of native trails leading to more propitious areas. This land use continued after Spanish contact in the 1700s, until the discovery of gold in the Sierra Nevada foothills. That event sent countless fortune seekers to the West, although the harsh environment of the Mojave Desert helped isolate the area for another decade and a half. Ultimately the lure of precious metals became too great and prospectors began their work, discovering large, silver and copper-bearing lodes in the mountainous areas throughout the current Preserve.

Early Transportation Corridors

At least two main Native American routes crossed the area of the Preserve (King and Casebier 1981:281). The Mohave Indian Trail, or Mojave Road, began at Piute Creek on the east side of Lanfair Valley, continued through Rock Spring in the Mid Hills and Marl Springs at the foot of the Marl Mountains, crossed Rocky Ridge, and ended at Soda Springs at the western edge of the modern Preserve before continuing along the Mojave River. A second, more southerly route crossed Foshay Pass through the Providence Mountains, continued north of the Kelso Dunes, and skirted the southern edge of Soda Lake before reaching the Mojave River. These travelways were likely the same ones used by early Spanish explorers.

The first non-native, historic-period utilization of the Mojave Desert was as a passageway between destinations. For almost a century, no permanent settlements of any kind were established in the region. In an attempt to find an overland crossing between Sonora and the missions of Baja California, several early explorers began charting a route through the vast desert as early as 1771, with the

first recorded Spanish exploration within the Preserve boundaries in 1775. Straying from the main southern route of an expedition led by Juan Bautista de Anza, a Spanish-born Franciscan priest named Father Francisco Tomás Garcés, led by Mohave Indian guides, traveled from the village of Santa Isabel on the Colorado River near present-day Needles. He continued westward towards Vontrigger Spring, moved through Lanfair Valley, traversed the Providence Mountains, stopped at Marl Spring, possibly passed the eastern border of Soda Lake, and followed the Mojave River Valley through Cajon Pass to the future site of San Gabriel Mission (Hewett 1956:4). Several other early Spanish expeditions opened up the Old Spanish Trail through the desert. Three alternate routes have been debated by historians, including the use of the old Mohave Indian Trail (King and Casebier 1981:281; Norris and Carrico 1978:19), although it seems likely that all three of the routes were in use depending on varying water sources and Native American relations.

In 1826 Jedediah Strong Smith became the first documented European American to cross within the boundaries of the Preserve. On his way to California, Smith passed through the Mohave villages on the Colorado River and continued through the Mojave Desert along the Mohave Indian Trail. In the following years, emigrants used the route, especially fur trappers, although there was limited water and it was dangerous due to Native American hostilities.

Early Mining and the Gold Rush

Prior to Spanish, Mexican, and early Euroamerican exploration, Native Americans had been mining for turquoise and possibly clay around the region of the Preserve. Archaeological investigations of the turquoise-mining district just north of the Preserve boundaries at the Toltec Mine began as early as 1899. In the late 1920s, the San Diego Museum carried out an archaeological survey

of the area. Over 200 pits were recorded, as well as basalt tools and potsherds (Miller and Miller 1976:51). The archaeologists determined that certain artifacts were not locally made, but were rather “Puebloan” in style, and it was therefore theorized that the mining was executed by people who originated from further to the south in the areas of New Mexico and Arizona. This was supported by the legend told by Piute Johnny, son of Chief Tecopa, who was recorded as saying,

Thousands of years ago this region was the home of the Desert Mohaves. Among them appeared a strange tribe from the south, searching for precious stones. They made friends with the Mohaves, learned about the mines and obtained great quantities of turquoise. They showed the Mohaves better methods of mining and taught them rock carving. These people were unlike any other Indians. They had light complexions and fair hair. They were peaceable, industrious and possessed of many arts. Their influence on the Mohaves alarmed the Piutes who distrusted the “strange people.” They believed the rock carvings were bad medicine. The Piutes resolved on a war of extermination and after a long, desperate conflict, most of the strangers and Mohaves were slain. Since that time, perhaps a thousand years ago, the mines have been abandoned [cited in Cloudman, Huguenin, and Merrill 1919:867].

Spaniards discovered placer gold as early as 1779 on the west bank of the Colorado River, about 10 miles northeast of present-day Yuma, Arizona. Gold was also mined in 1781 by Spaniards in the Cargo Muchacho Mountains on the southeastern border of Imperial Valley. Both undertakings were short-lived due to hostilities with the local Yuma tribe. Beginning in 1842, Mexican Californios mined for gold in Placerita Canyon north of Los Angeles and may have been mining in the upper Mojave

Desert region as early as the 1830s (Gardner 1954:51; Shumway, Vredenburg, and Hartill 1980:41). All of these activities revealed merely a glimmer of the minerals yet to be discovered and exploited in the California and the West.

In 1848 gold was discovered by James W. Marshall at Coloma, some 400 miles to the north on the American River. The rush began and immigrants flooded into California (Figure 5). Although a few of the earliest to arrive found riches in the placer deposits of the Sierra Nevada foothills, the most successful were entrepreneurs who brought in the goods and services to those who mined. The influx also brought an extreme variety of cultures and nationalities. The success of California gold mining was astronomical. In 1852 California produced more than \$81,000,000 worth of gold—60 percent of the world production for that year (Clark 1957:223). The first hard-rock gold-mining operation in California was in 1850 at the Salt Springs “Mormon Diggings” near Death Valley. Mexican miners may have exploited the free placer gold in that area as early as the late 1820s. In 1849 a group of Mormons discovered the deposit and the mine was reportedly productive over the next two years.

William Ireland Jr., California State Mineralogist (1886–1893), described the almost chaotic events of early mining in California; he wrote that it all began “without efficiency or a long term plan to develop a stable economic enterprise. There was great waste and improvisation. The rich free-milling ores of both the early Gold Rush and the 1859 Comstock silver rush were so easily obtained that when they played out methods were not available to extract the minerals easily from the country rock. There was a stall in production while the industry struggled to maintain the output from earlier years” (Ireland 1891:14). By the late 1860s, production had dropped to \$20,000,000.

Almost immediately after the discovery of gold, investors began talking about the construction of a transcontinental railroad that would connect eastern goods, money, and services to the new western enterprises. Surveyors scouted the area of the Preserve several times as the potential location

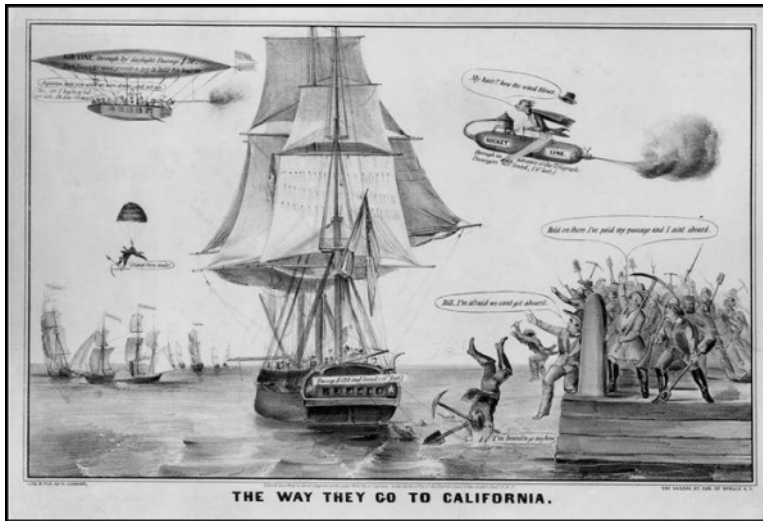


Figure 5: *The Way They Go To California* (Currier 1849). Fortune seekers, adventurers, business people...anyone coming from the eastern United States had to travel to California in one of three ways: overland, 'round the Horn, or through the isthmus of Panama. Whichever way they chose, the route was filled with danger and hardship. But the draw of gold was enough motivation so that by the end of 1850, almost 100,000 people had made the journey.

for a southern route. In 1853 Francois X. Aubrey may have crossed the Mojave Desert near the Clark Mountains (King and Casebier 1981:289). On his second trip the following year, he may have crossed the Mojave along what became known as the 35th parallel route (following the 35th parallel latitude). Also in 1854, U.S. Army engineers Lt. Robert S. Williamson (exploring from the west) and Lt. Amiel W. Whipple (exploring from the east) surveyed the area. Mojave Indian guides led Whipple's group across the desert. They followed the Mohave Indian Trail and Whipple named several places that still bear that designation, including Rock Spring, Marl Springs, and Soda Lake. The group camped at Marl Springs on 8 March 1854. After passing through Cedar Canyon on their way from Rock Spring, Whipple wrote, "The spring was small, and there was not more than half enough water for the mules. But as it constantly though slowly flowed in, after awhile the animals were satisfied, and we obtained water for the uses of camp. . . .the grass is highly nutritious. *Cactaceae* are abundant. Tall and beautiful *yuccas*, the offensive *larrea Mexicana*, and *obione* [common name 'greasewood'], complete the list of vegetation" (Foreman 1941).

In 1854 the General Land Office began sending surveyors into the area to create township lines by setting up markers throughout the desert. Native Americans from the Mohave villages near the Colorado River responded to the increased traffic by raiding the American travelers. Wagon trains

were attacked and the Mojave Road was closed for a short while until several military outposts were established in the area and the Mohave people were overpowered (Norris and Carrico 1978:37–38). The railroad was eventually completed along the 35th parallel route, almost 30 years later.

Generally, the desert was merely a gateway for the throngs of people heading to the northern goldfields (Brown and Boyd 1922:102). Most of the early California gold mining was in placer deposits, which could be worked by individuals or small groups with sparse equipment and little investment. Miners did not even recognize silver while wearing their gold-colored glasses: 'that darned blue stuff' just kept clogged up the milling equipment. The discovery, and recognition, of silver at the infamous Comstock Lode in Nevada in 1859 changed all that. Attention turned from gold to silver and from the mountains to the desert, and discoveries were made throughout the arid regions of Nevada and southern California. But because the area was remote, water scarce, and transportation practically nonexistent or at the least very difficult, mining operations in the Mojave Desert and within the Preserve boundaries were initially underdeveloped (Brown and Boyd 1922:102). Silver mining in the desert required significant investment compared to early gold placer mining, because most silver deposits were in deep lode-bearing veins that required complicated and expensive equipment as well as efficient teams of men to operate and maintain the mines.

Environmental Considerations

The desert can be a foreboding place and its setting was an important element in the delayed development of the area. The area is dry, sometimes with less than 6 inches of rain per year. There are also extreme temperatures. In summer temperatures can reach 120 degrees Fahrenheit, while in the winter temperatures commonly drop below freezing, especially at higher elevations. Miners needed both water and wood to survive and be productive. In the desert, water sources are scarce and there are only small pockets of usable timber. The importance of timber has been illuminated by the numerous pack-mule trails that were created in the few wooded areas (Reynolds 1995:85–88; Reynolds and Reynolds 1995:143–148). The elements determined the influx of miners and investors into the region, dictating the kinds of operations that could be established and the types of technology that could be used.

THE MAKING OF A MINE

Development of Mining Claims and Districts

Early in the mining history of California, miners developed a formalized system for establishing mining claims and organizing mining districts that became a crucial component for the success of mining operations in the West. The system they created established boundaries and promoted a generally fair method for developing mineral discoveries. The miners who originally set down the new regulations themselves had previous backgrounds in the legal system, as Jeremiah F. Sullivan, former president of the San Francisco Bar Association and superior court judge of San Francisco, explains below:

Many brilliant young lawyers during the early days of California were lured away temporarily by the hidden gold of mountains and tempted to play with running water and pan and rocks to obtain the glistening metal that might pave for them a pathway to success in

life. But the jealous mistress, the law, called them back [1925].

These lawyers were the first to establish the system of mining claims and districts that were eventually adopted into the General Mining Act of 1866 and the succeeding Mining Act of 1872. Judge Stephen J. Field, United States Supreme Court Justice from 1863 to 1889, summarized the influence western mining had on mining throughout the United States:

The rules and regulations originally established in California have in their general features been adopted throughout all of the mining regions of the United States. They were so wisely framed and were so just and fair in their operation that they have not to any great extent been interfered with by legislation state or national. In the first mining statute, passed July 9, 1866, they received the recognition and sanction of Congress, as they had previously the legislative and judicial approval of the states and territories in which mines of gold and silver were found [n.d., cited in Sullivan 1925].

The basic components of the General Mining Law, summarized by Irelan (1891:883–897), includes the basic tenet that vacant public land was open to prospecting, location, and development of minerals. Differences were established between the prospecting and development of lode and placer claims. For lode deposits, a claim made after 10 May 1872 could not exceed 1,500 ft. along the lode. The claims had to be at least 25 ft. and could not exceed 300 ft. in each direction from the middle of the lode. The end lines of each claim had to be parallel. A claimant had rights throughout the entire depth of his claim within the surface lines. No mineral rights were given until after the discovery of a vein or lode-bearing mineral. A claim located before 10 May 1872 required annual labor or improvement on the lode of \$10 per each 100 ft. until a patent was issued. A

claim located after 10 May 1872 required \$100 annually of labor or improvement for each claim. A placer claim was limited to 20 acres for an individual and up to 160 acres for a group. For claims located after 10 May 1872, an applicant must also perform \$100 worth of labor or improvement a year on the claim in order to hold it. Failure to perform the annual assessment or file an affidavit with the County Recorder's Office was considered an abandonment of claim. Claims had to be clearly marked on the ground, which was often done with small rock piles or wooden posts.

The Act also established that miners could organize districts, with each having specific boundaries, an elected Recorder, and its own set of rules and regulations (Figures 6 and 7). Like claim boundaries, district boundaries had to be noticeably marked on the ground, often accomplished with rock piles, or cairns, and then officially recorded in the County Recorder's Office. The members of each district also established the regulations that controlled the size, location, recording, and amount

of work necessary to hold a claim, although those regulations could not contradict United States federal law or an individual state's law. For instance, a district group could declare that a claim could only be a maximum of 25 ft. on each side of a lode and a maximum of 100 ft. long. Many districts were never officially defined and received their title simply as areas of exploratory interest. Mining Districts in Mojave National Preserve. Robin Laska (2005) of the San Bernardino County Information Center of the California Historical Resources Information System has confirmed a minimum of 111 mining districts in San Bernardino County. At least 32 of those districts were located within the boundaries of the Preserve (Table 1; Weasma 2005a).

Regarding other types of claims, the Act established that a mill or processing site had to be located on non-mineral land and could not be larger than 5 acres. An iron deposit located prior to 10 May 1872 was governed by the local laws of the district. A ledge located after that date could not exceed 1,500 ft. along the lode and 300 ft. on each side from the

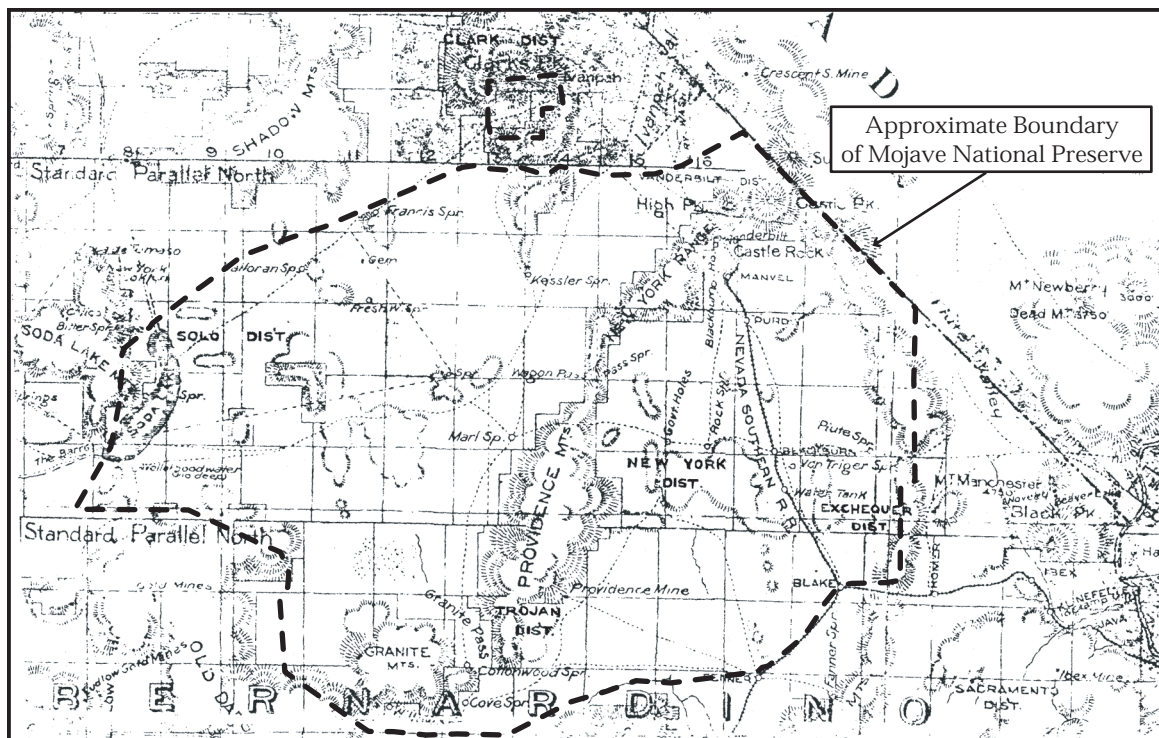


Figure 6: 1896 Perris Miner's Map. *The mining districts of 1896 are clearly laid out in this map, as well as the locations of trails and watering holes.*



Figure 7: 1902 Bailey Map. District locations do not seem to have changed much in the six years between the two maps, but by 1902 the Nevada Southern Railway (renamed the California Eastern) had been extended past Manvel (Barnwell) through a pass in the New York Mountains to the Ivanpah Valley. The success of the Copper World mine in the Clark Mountains and the construction of the smelter at Valley Wells prompted this northward growth (Bailey 1902).

Table 1. MOJAVE NATIONAL PRESERVE MINING DISTRICTS

Compiled by Ted Weasma, Geologist, Mojave National Preserve
(revised 11 October 2005)

Arrowhead (Arrow)	Kewanee
Bullion (Standard)	Macedonia(n)
Cima	Marl
Clark (Copper World)	Mescal
Dry Lake	Mid Hills
Empire (Old Dad)	Old Dad (Old Dad Mtn./Empire)
Exchequer	Providence Mountains (Trojan)
Goffs (Von Trigger, New York)	Rock Springs
Goldstone	Signal (Von Trigger)
Gold Belt	Silver Hill
Hackberry Mountain	Soda Lake
Halloran Springs	Solo
Hart	Standard (Bullion)
Ivanpah (Copper World)	Trojan (Providence/Brightwood)
Kelso	Vanderbilt
Kessler	

center of the lode. When an iron deposit was not in ledge form, 20 acres per person was allowed or 160 acres to a group of more than eight people (similar to a placer claim).

A claimant could obtain a patent for the land after \$500 worth of development on the claim was proved. The cost of obtaining a patent was \$2.50 per acre for a placer claim and \$5 per acre for lodes and mill sites. Once a claim was patented, it became private property.

Mining-claim books researched to date show that no less than 1,700 claims were filed between 1863 and 1950; that is a mere sampling however, as many more mining-claim books exist that have not been examined (Figure 8; Weasma 2005b). Many mines were located outside of formalized districts. Although provisions required mining districts to formally record the exact location and size of the boundaries, early districts were often organized prior to any official survey of the land and were therefore vaguely defined. Districts often

overlapped by using the same geographic references. Over time, district boundaries would also divide, expand, shrink, and reorganize.

Corporations and Company Towns

The complexities of hardrock mining required a more structured organization than was necessary during the earlier California placer-mining activities. The evolution of industrial capitalism and the expansion of corporations were key elements for the success, and sometimes failure, of hardrock mining all over the West including the eastern Mojave (Lingenfelter 1974; Wyman 1979). The amount of capital necessary for establishing a hardrock mining operation required organization that went beyond the means and abilities of an individual prospector with his pickaxe. After initial discovery, a prospector would generally stake the most productive claims and mine enough mineral ore to interest outside investors. Hauling equipment and resources into a mining area, as well as transporting ore to milling operations on the outside, was a complex effort and

very expensive. The purchase and installation of milling equipment was also costly.

Corporations, and outside investors via the stock exchange, financed those distant mining operations. The San Francisco Stock and Exchange Board was created in 1862 and was the first stock exchange in the United States devoted to mining operations. In 1875 the competing Pacific Stock Exchange was formed. By the end of that decade, several more mining exchanges were organized, including the American Mining Stock Exchange, the National Mining and Stock Exchange, and the New York Mining Stock Exchange (Sears 1973).

The establishment and administration of a hardrock mining operations involved many different individuals, each with a specific role or task in the production and maintenance of a mine. A group of shareholders would elect a board of directors that was head by a principal corporate

owner or president. Often a wealthy financier controlled the corporation, and the president, from the outside. At the mine, a superintendent and a mine manager directed the daily operations. Mines also required an array of skilled workers, including miners, blacksmiths, assayers, machine operators, cooks, laborers, clerks, and bookkeepers.

“Company towns,” such as Providence at the Bonanza King Mine and Nantan at the Mescal Mine were constructed to house the employees. The corporation often managed a store that provided the goods and services necessary for daily existence. Workers were often in debt to their employer because of high-priced goods and rents and the practice of borrowing against unpaid wages (Brown 1979:99–117). Other towns such as Barnwell (Manvel), Vanderbilt, and Hart developed more informally as different mining areas thrived. Those towns served as supply centers and depots for

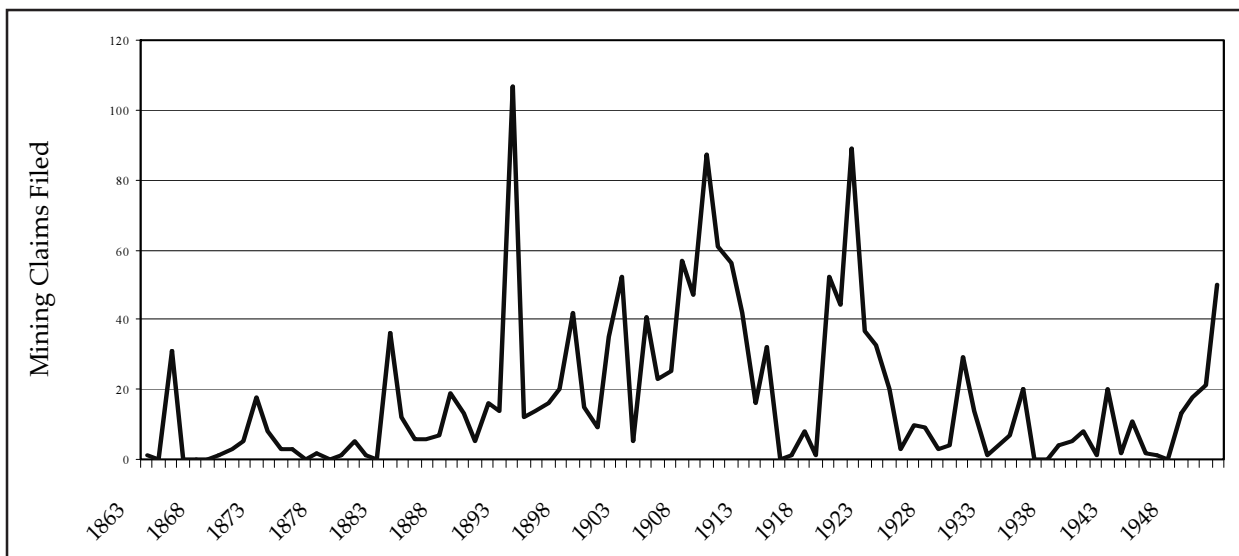


Figure 8: Claim Activity. Almost 500 mining claim record books exist for the years 1863 through 1949. Weasma (2005a) has reviewed all or portions of approximately 100 of these books, therefore the data on the above graph represent a small sample of claim activity in the Preserve area. It is interesting that despite the limited data set, a clear pattern of activity is evident. Spikes in filed mining claims occurred just following silver discoveries in the current Preserve area, with additional increase in 1873 and 1885. The greatest amount of claim activity occurred in 1894, consistent with the discovery of several important gold-producing areas. Claims continued to be filed at a relatively constant rate through the end of World War I. Another increase occurred in the 1920s, followed by a general decline with small bursts of activity in the 1930s and 1940s.

outlying mining areas and were essential for other desert industries as well, such as farming and ranching.

Technological Developments

Initially, miners in California used methods and equipment that had been in use for centuries, mostly developed in the tin and copper mines of Cornwall and adapted by immigrant Cornish miners in Wisconsin and Michigan prior to being brought west for the California goldfields. Men excavated the mine tunnels and shafts with hand drills and black powder, a time-consuming and therefore costly process. At small ventures, miners used the hand whim, or windlass, to remove ore from the mineshaft. At larger operations, the horse whim was used, which was a mechanical hoist consisting of a rope reel turned by a pack animal (Figure 9). The rope was attached to a pulley hung from the top of a headframe that was placed directly over the shaft opening. As the horse rotated the reel, an ore bucket was raised or lowered into the opening. Flooding was often controlled by steam-powered beam engines, invented for Cornish mines during the 1700s (Twitty 2002:18–20). Miners crushed the ore with the Mexican-style arrastra (Figure 10). The arrastra construction included a circular track of stone with a center post and a horizontal shaft. One or more large stones were attached and drawn by donkey- or mule-power to grind the ore to powder.

Beginning in the late 1860s, several technological inventions were developed that revolutionized hardrock mining (Figures 11 and 12). Dynamite and the fulminate detonator, invented by Alfred Nobel in 1868, greatly improved the output of mines by increasing the success of an individual blast and therefore hastening expansion. Shortly thereafter, Charles Burleigh introduced the compressed-air or steam-powered machine drill, capable of striking up to 300 blows per minute. Although many had been attempting to invent a mechanical drill, Burleigh's simple yet solid design proved effective and enduring. The drill was able to excavate at more than five times the speed of hand-drillers. Additional improvements included the development of wire rope, especially flat hoist

cable, for lifting ore buckets (1860s); the introduction of square-set timbering for bracing shaft walls (1860s); the invention of the steam-powered hoisting system (1870s); increased improvements in flood control and ventilation techniques (beginning in the 1880s); and the application of electricity, both inside the mine as well as in the surface plant (beginning in the late 1880s) (Irelan 1891; Twitty 2002; Wyman 1979). The development of the use of cyanide, which successfully extracts gold from low-grade ore, revolutionized gold processing in the early 1890s. In the 20th century the gasoline engine transformed milling techniques, eliminating steam power. Gasoline-powered automobiles changed not only mining but all aspects of desert life by opening up travel routes and easing transportation difficulties. Roads were established throughout the Preserve area to accommodate the trucks that became integral to mining operations.

The Miners

At the outset the mining population was made up almost exclusively of single men. But miners needed food and supplies, and people who could provide those goods followed. Ultimately women and children also relocated to mining communities. The first reliable census for the Preserve area, taken in 1900, identifies that of the 329 people listed, 28 were women and 39 were children. Census data for 1900, 1910, 1920, and 1930 suggest that the population within the Preserve area remained relatively constant through those decades, although there may have been population spurts in the years between census takings due to brief mine expansions and closures as well as the involvement of the United States in World War I (Table 2).

Ethnicity played a role in the hierarchy of mining life. In the hardrock mining business, it was most often native-born Euroamericans who made discoveries and carried out initial development. It has been asserted that native-born Americans were a minority at most established mining locations; they were typically the first to arrive and the first to leave, moving on to discover new deposits. With a strong mining tradition in their home countries, Cornish and Irish immigrants were usually in the majority

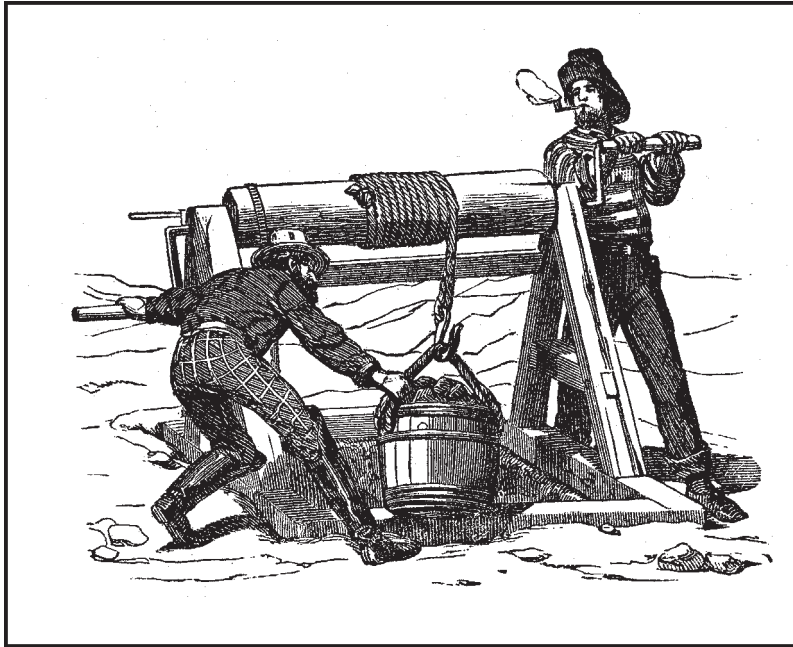


Figure 9: *Horse Whim and Windlass (Ingersoll Rock Drill Company 1887:60; Olmsted 1962). Prior to the introduction of steam-powered equipment in the late 1860s, effort by man and beast were the only methods for extracting and processing ore. It was a slow and demanding process; yet if successful, well worth the effort.*

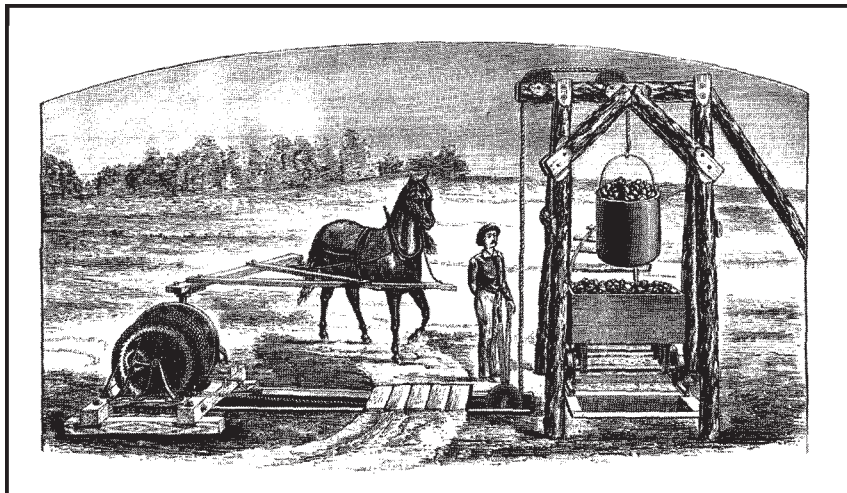


Figure 10: Arrastra (Rickard 1907). At least 5,000 miners came to California from the Mexican state of Sonora during the early years of the Gold Rush and with them came tools and techniques used in Mexico for generations. The design of the arrastra (from *arrastrar*, “to drag”) may have originally been introduced from the Middle Eastern threshing floor to the northern Mediterranean, where it was adapted for mineral ore processing (Young 1970:69).

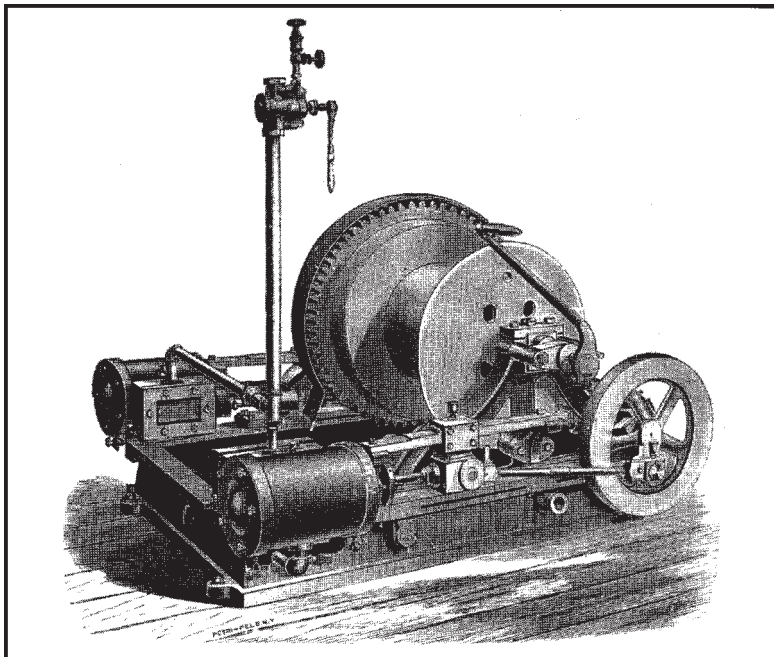
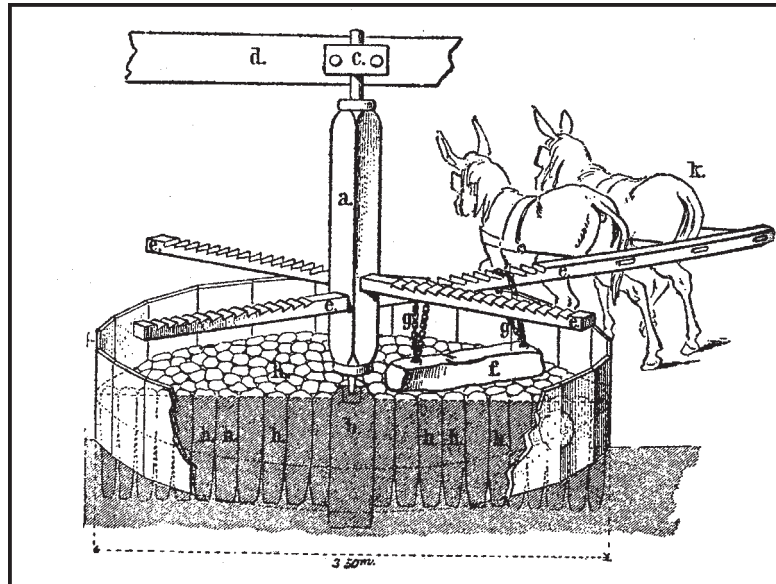


Figure 11: Steam Hoist (Ingersoll Rock Drill Company 1887:60). The power of steam had been tested in British and North American mines for decades prior to its revolutionary use in the 1860s. No longer reliant on physical power to operate a mine, output became faster and more productive. But the expense of installing and operating the machinery was not feasible for many miners and the increased competition caused greater corporate involvement that eliminated many smaller operations.

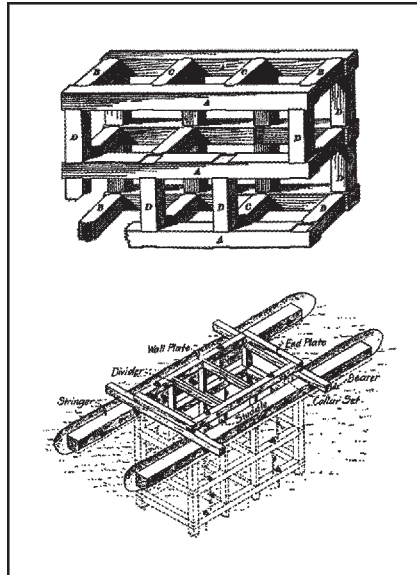


Figure 12: *Square-sets* (Anonymous 1913:546; *International Textbook Company* 1899, A40:25), or *shaft-sets*, were introduced by Western mining engineers in the 1860s. Construction began at the collar or opening of the mine and continued down, with miners assembling and continuously adding open cubes as the shaft was sunk deeper.

at the larger camps (Lingenfelter 1974:3). Interestingly, census data for the Preserve area indicate that most miners between 1900 and 1930 were, in fact, born in the United States, with the second largest group being Mexican-born. While Mexican miners faced discrimination at the Comstock mines by the 1880s, they continued working Mojave Desert mines through the 1800s and into the 1900s. Chinese were banned from working in the larger mining operations, although some may have been employed in the camps as cooks and laundrymen (Lingenfelter 1974:3–5). Some mining districts restricted Chinese employment in their by-laws (Vredenburg 2006, pers. comm.).

High wages in western mining operations were a draw for both European and American miners. Wages initially averaged \$4 a day, although in later years this dropped to \$3 or even \$2.50 a day. Nevertheless, this was significantly higher than the national average: between 1870 and 1899 wages for non-farm labor ranged from \$1.04 to \$1.57; for carpenters, \$2.23 to \$3; and for iron manufacture, \$1.99 to \$2.03. Coal miners in Illinois earned from \$1.67 to \$1.80 a day and those in Pennsylvania from \$1 to \$2. European wages were even lower (Wyman 1979:35–36).



**Table 2. Census Information for Townships within
the Current Mojave National Preserve**

(U.S. Census 1900; 1910; 1920; 1930)

Population Count

	Total	Men	Women	Children	0-5	6-17	18-30	31-50	over 50
1900	298	216	44	38	13	27	64	132	62
1910	257	145	51	61	26	35	70	85	41
1920	227	147	41	33	14	19	51	86	51
1930	493	240	104	149	59	91	114	157	72

Place of Birth/Ethnicity - Adults Only

	California-born	Western States	Other U.S.	Canada	European	Mexican	Chinese	Japanese	Black	Native American
1900	31	28	146	10	30	1	2	0	0	29
1910	9	10	108	5	27	30	0	1	2	1
1920	14	5	95	0	21	48	1	0	0	5
1930	19	37	181	4	23	62	0	2	9	3

Occupation

	Miner/ Mine-related	Transportation	Services	Ranch/ Farm	Cook/ Laundry	Professional	Literate Yes	No
1900	161	16	21	10	9	4	272	7
1910	78	50	17	8	6	7	224	11
1920	41	71	17	18	3	1	177	21
1930	43	139	34	26	/	4	365	20

Reliable census data for the Mojave area began in 1900. The total population remained relatively constant until 1930 when presumably the effects of the Great Depression caused the population to nearly double. Throughout the decades men always outnumbered women and children although the gap gradually lessened over the years. Most residents were born in the United States, especially states east of the Rocky Mountains. For many, the Mojave Desert appears to have been a first stop or a gateway. The Mexican-born population increased significantly over the decades. Native Americans were counted on a separate form in the 1900 census, although the drop in population is a clear reminder of the occupation of Euroamericans. Note the turnaround between those employed by mines and those by transportation from 1900-1930. Interestingly, the 1910 census from Hart township listed a prostitute operating out of her own house.

HISTORIC CONTEXTS FOR MINING IN MOJAVE NATIONAL PRESERVE

SILVER MINING IN MOJAVE NATIONAL PRESERVE, 1863–1893

The first mining in the Preserve area focused on silver. Following the initial discovery southwest of Rock Spring in 1863, mining activity was dormant for several years until a major discovery in the Clark Mountains renewed interest in the region. Prospectors combed the Clark Mountains as well as the Providence, New York, Ivanpah, and Mescal mountain ranges in the 1860s, 1870s, and 1880s. This period of mining was characterized by major mineral discoveries but a lack of good transportation. Much of the ore was processed on-site, reduced to an impure bullion that was shipped out for final refining. Goods and services were hauled in with pack animals or wagon trains. Water was scarce and the desert environment was harsh. Fluctuating silver prices, mostly due to national bank failures and political decisions, added to the boom-and-bust cycle of mining throughout the region. When many countries throughout the world

began to switch their economic base from a bimetallic silver and gold standard to a monometallic gold standard, a political battle developed in the United States between hard money loyalists and free-silver Populists. The ultimate victory of the gold standard caused the demise of most silver-mining operations in the West, which led to the search for and exploitation of gold and other mineral resources such as copper.

Rock Spring Discovery

Although soldiers may have prospected near Marl Springs as early as 1860 (VerPlanck 1961:5), the first recorded mineral discovery in the Preserve was approximately 10 miles southwest of Rock Spring in Macedonia Canyon in the Providence Mountains (Figure 13). Given the remoteness of the region, the discovery was, not surprisingly, very close to the Government/Mojave Road. On 12 March

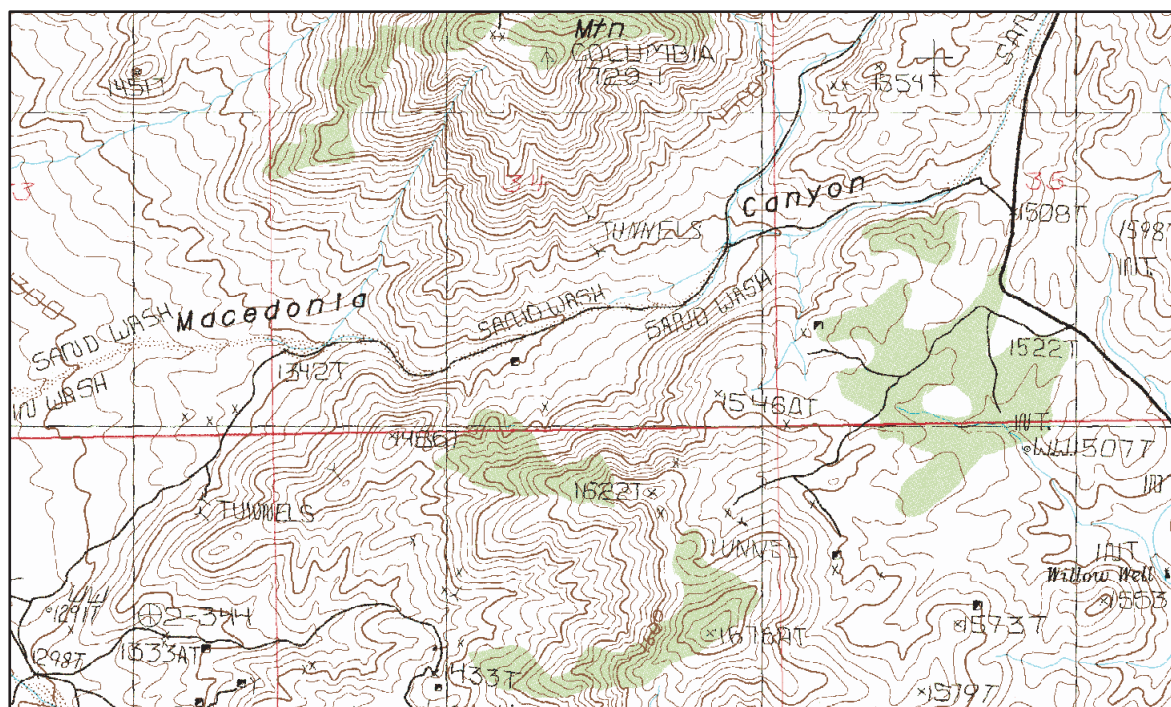


Figure 13: Macedonia Canyon and the Columbia/Macedonia Mine (USGS Columbia Mt., Calif. 1983).

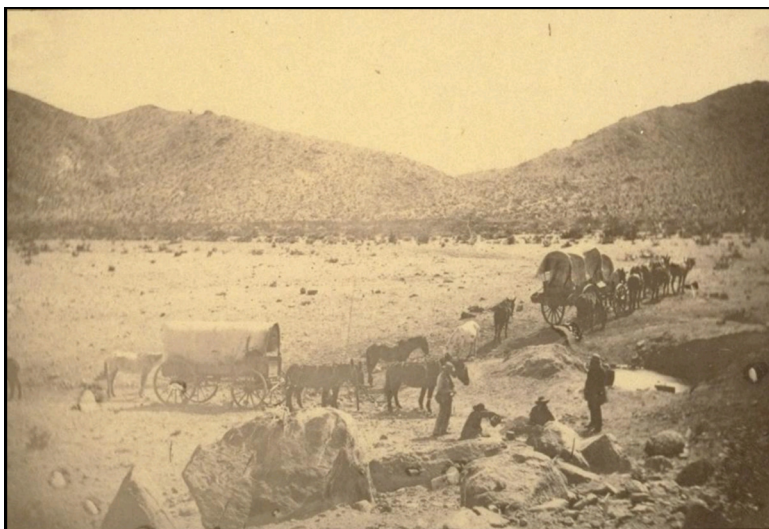


Figure 14: Rock Spring (*Photographic Views of the Mojave Route, El Dorado Canyon and Fort Mojave, 1863, BANC PIC 1905.16894—A, The Bancroft Library, University of California, Berkeley*). Traveling along the Mojave Road in the 1860s was probably an uncomfortable and dehydrating experience. Water locales were few and far between and most are intermittent. Here, it appears as if Rock Spring is going to outfit the company for the next leg of their journey.

1863, Charles Hamilton and Francis B. Austin discovered a rich vein of silver and named it the Dona Carolina. Although this is the first recorded mineral discovery in the Preserve, newspaper accounts at the time claimed that the area had previously been worked by Spaniards (*San Francisco Alta California* 22 May 1863, 16 October 1863). The following month, the Rock Spring Mining District was founded, complete with regulations, bylaws, and officers. The district encompassed an area of 30 square miles bounded by Macedonia Mountain to the north and Silver Hill Mountain to the south. Additional silver veins were discovered within the next few months and investors began forwarding goods and assets to the area. By the following year, five San Francisco mining companies had interests in the district (Shumway, Vredenburg, and Hartill 1980:58). More miners flowed in and more claims were filed so that by November of 1863 the district was subdivided into the Macedonia, Rock Spring, and Silver Hill districts—indicative of the significant amount of activity in the area (Figure 14).

The mines were soon closed, likely because of Indian attacks. One attack occurred in 1864. Near a rich mineral deposit discovered by a Dr. Winston of Los Angeles (*San Bernardino Guardian* 21 September 1872), the miners were attacked by a band of Indians “with battle ax in hand and a yell which was enough to strike terror to the heart of the boldest miner” (cited in Thompson and Thompson 1995:136–137).

Winston and his group abandoned the mines. Other attacks occurred during the next few years, including the murder of a miner named Moses Little on 12 June 1866. In December of 1864, the U.S. Army established Camp Rock Spring to protect the mail route on the Government/Mojave Road and subsequently suppress attacks on miners (Shumway, Vredenburg, and Hartill 1980:58). Miners returned to the Rock Spring/Macedonia Mine in 1871 and the following year Matt Palen, a prospector and miner from the Clark Mountain area, established a smelting operation. By the end of September, 15 tons of ore were shipped to San Francisco (Shumway, Vredenburg, and Hartill 1980:58). Likely because of the economic collapse of 1873, the mine was shut down and was not reworked for almost three decades.

Clark Mountains

The next major mineral discovery in the Preserve area was made in 1869 when a Paiute Indian told pioneering prospector John Moss of a rich copper vein on the west slope of Clark Mountain (Figure 15). Moss had come to California in 1857 and was employed as a Pony Express rider for a brief period before discovering a rich gold deposit in Arizona in 1863. The following year he escorted the Mohave Chief Irataba to Washington D.C. to meet Abraham Lincoln. He reportedly had a stable relationship with the Native Americans in the region, having negotiated a treaty between the

Euroamericans and the Pima, Maricopa, Yuma, and Mohave tribes (Vredenburg 1996a:67).

After the initial discovery, San Francisco investors sent a group, led by Moss and including mining engineer James H. Crossman and businessman and saloonkeeper William H. Clarke, to explore the discovery. They found not only the copper locale but also discovered a vein of silver on the east side of Clark Mountain (Shumway, Vredenburg, and Hartill 1980:63). The group staked over 130 claims and formed the Clarke (later renamed Clark) and Yellow Pine Mining districts (Vredenburg 1996a:67). The San Francisco investors organized the Piute Company of California and Nevada on 18 July 1869 and began to develop the silver mines (Hensher 1984:37). Crossman became the mine manager. The company also staked the Copper World claims on the south side of Clark Mountain. Those mines were active for a brief time in late 1869, but it was not until the end of the century

that the Copper World would become one of the largest producers of copper in California.

Moss was able to create an agreement with the local Paiute tribe to leave the miners unharmed and allow them to work as well as hunt. The treaty remained unbroken until a group of three German miners was killed in the Avawatz Mountains. When Moss confronted the Paiute, they stated that they did not kill white men, merely Germans. Moss explained that the German men were included in the white race and the treaty was re-established (Thompson and Thompson 1995:138).

Shortly after the discovery, the Piute Company planned four townsites. A 160-acre area on the southeast slope of Clark Mountain was designated for the town of Ivanpah, which ultimately became the focal town and milling complex for the region. It was several miles from the mines but had a good spring (*ivanpah*, from an Indian dialect, translates to 'a small spring coming out from a white saline

Figure 15: *John Moss and Piute Chief Tercherrum (Photographic Views of the Mojave Route, El Dorado Canyon and Fort Mojave, 1863, BANC PIC 1905.16894—A, The Bancroft Library, University of California, Berkeley). This photograph was taken prior to the discovery of silver in the Clark Mountains. Moss was a quint-essential desert pioneer and prospector. His relationship with local Native American tribes was likely vital to his success in the region.*



soil' [Hensher 1984:39; Hewett 1956:2]). Two miles north of the Ivanpah townsite was the Eugene Mine, where about 100 men worked, including about 50 Native Americans (Shumway, Vredenburg, and Hartill 1980:64). The presence of the native Paiute tribe in the area is demonstrated by the following account. During his 1871 survey, Chief of Engineers Brigadier General A.A. Humphreys wrote:

After leaving Owen's River Valley no Indians were seen until Ivanpah was reached; here there are quite a number, who, for the most part, are employed by the miners to carry water to the mines. This idea of labor is not applicable to the men, as they as a general thing are perfectly contented to enjoy the fruits of the labors of their squaws; some few, however, who have been for a long time with the whites, work at times, but it is safe to state only when compelled by hunger. They belong to the tribe of Pi-Utes, or Pah-Utes, as do also the Indians at Cottonwood Springs, Vegas, along the Muddy, and at Saint George. At present those at Ivanpah are perfectly harmless, but only from realizing the superiority of the whites over them. Two years ago, when the mining camp was occupied by only a few men, the majority having gone to Visalia and Los Angeles for provisions, they entered the town and compelled the few people left behind to cook for them what little in the way of provisions was left. Fortunately the wagons arrived while this was going on, and the Indians were driven off; they returned in a few days, however, and asked for food. At the time I passed through I should judge there were nearly one hundred in all encamped about Ivanpah [1872:75].

Three other townsites were designated, including Cave City on the north side of the mountain near the main group of mines; Good Spring on the Nevada side of the state line; and Pachocha, or Pachalka, on the west side of the mountain range. By the summer of 1870, 300 miners had traveled to the mines. By 1871 water has become so scarce that a well was excavated (Humphreys 1872:53). Initially ore was transported to San Francisco, first by wagon to San Bernardino, on to the coastal shipping ports, and then by ship north. Shipping the ore was expensive, about \$70 a ton. On 21 August 1870 miners and other businessmen got together to discuss the problem of the lack of good transportation from the mines to shipping points on the coast (Figure 16).

In August 1871 Ivanpah had a hotel, two stores, several small adobe houses, and the office of the Piute Company (Hensher 1984:39). A smelter was constructed in 1873 (Shumway, Vredenburg, and Hartill 1980:65). The mines were located several miles northwest of the town, where the Mineral (Alaska) Mill began operating in June 1876. Productive mines included the Hite & Chatfield (later called the Lizzie Bullock), the Monitor and Beatrice mines (owned by the McFarlane brothers—Tom, Andrew, John, and William), and the Colosseum Mine. The Emperor Mine produced both silver and lead. Matt Palen had a group of silver claims near Alaska Hill called the Stonewall Jackson, later Stonewall Mine. During peak production the mines produced silver ore worth between \$700 and \$1,700 a ton (Warren et al. 1980:216–217; Hewett 1956:7). Despite the success of the mines, Ivanpah never attracted eastern investment.

In 1875 the McFarlane brothers moved a five-stamp mill from the New York Mountains to the Clark Mountains. During that sixth year of operation, the district produced \$300,000, mainly in silver. At least 80 men lived at Ivanpah that year (Shumway, Vredenburg, and Hartill 1980:66).

When Frederick Samuel Dellenbaugh passed through Ivanpah in March of 1876, he mentioned one stamp mill, another mill under construction, two stores, and several houses. He also noted that the



Figure 16: *Ivanpah (Piute Company of California and Nevada 1870). A year after the discovery of silver in the Clark Mountains, the town of Ivanpah had sprung up on the mountain's eastern edge. This illustration was originally included in a promotional pamphlet designed to introduce the new mining district.*

buildings did not reflect the true population of the area, because many miners camped at their claims (Warren, Knack, and von Till Warren 1980:216). The mill under construction was a 10-stamp mill located 1 mile east of Ivanpah that was funded by J.A. Bidwell and a partner (Hensher 1984:44).

A post office was established in Ivanpah in June 1878 (Durham 1998:1431), but the prosperity of the town was already beginning to wane. As described in the *Colton Semi-Tropic*,

'Pay day' in the Ivanpah Consolidated has come and gone and our town has [begun] to settle down into that quiet little camp of old. Ivanpah, like nearly all other California mining camps is either all excitement or else very quiet. They are made by excitements, spring up as by enchantment and as suddenly die. Ivanpah,

for three or four days after pay day, was as lively as the camps of '49.' Everybody had money and consequently nearly everybody was drunk, or trying to get that way. Fights were the order of the day, and every man that had a grudge against his neighbor wanted to settle it up and consequently . . . they all got satisfied [*Semi-Tropic* 1 May 1880, cited in Hensher 1984:48].

Although Ivanpah was a mining community, complete with all the usual trappings, on most occasions it was apparently quite subdued. In 1880 Ivanpah boasted a short-lived newspaper, the *Green-Eyed Monster*, named after a local mine (Shutka 1962; see Figure 17). Lacking any genuine happenings, young editor "Humbug" Bill Frazee was slightly inventive in his writings, for instance:

Sam Boyd came into camp a few days since, in a lather of excitement over his latest find. Its a real wonder and already partially developed. Over in the Yellow Pine District he has discovered an old shaft, apparently sunk during the boom of that section some twenty years ago. During the intervening years scores of prospectors and occasionally travellers [sic] seem to have stumbled into the shaft, never to emerge again. Hence, it is to-day, a veritable "general merchandise mine," as Sam calls it; jammed full, below the twenty-foot level, of every variety of prospecting gear—picks, hammers, pans, cooking utensils, clothes, boots, etc. Also many of the former owners are in a fair petrification owing to the extreme dryness of the climate hereabouts. Sam thinks they'll make fine mannequins for the display of newly-found merchandise. By Monday next he hopes to have a sign made for his establishment and he cordially extends an invitation

to all persons in the vicinity to drop in and inspect the shop. The prices are low and goods barely used [*Ivanpah Green-Eyed Monster*, 15 May 1880, cited in Shutka 1962:217].

In 1878 the McFarlane mines were bought out by the San Francisco-based group Ivanpah Consolidated Mill and Mining Company, but by the end of the following year Ivanpah Consolidated was in financial trouble. In order to sustain the company-sponsored store, the firm issued scrip to the workers. Within several months, the company had to shut down operations because they owed the workers months of pay, and the U.S. government a tax on the scrip. The government sued the company and won \$1,480.

Despite the disorder, the mines continued to prosper, especially after the opening of two new rich mines, the Alley and the Alps. In 1881 the Internal Revenue Service sent E.F. Bean to collect the government-won money from the mine owners. Upon arrival an argument took place between Bean, mine clerk J.B. Cook, Superintendent John McFarlane, and watchman Fred Hisom. In the ensuing quarrel, Hisom was knifed and retaliated by killing McFarlane. The killing was deemed

GREEN-EYED MONSTER.

VOL. I. IVANPAH, CAL., SATURDAY, MAY 15, 1880. NO. 3.

<p>GREEN-EYED MONSTER.</p> <p>PUBLISHED EVERY SATURDAY BY</p> <p>COOK & FRAZEE</p> <p>SUBSCRIPTION RATES:</p> <p>For one year, in advance, by mail, \$1.00 For six months, in advance, by mail, .50 For three months, in advance, by mail, .25 Single copies, 10 cents.</p> <p>FOR SALE!</p> <p>One Three Spring Wagon. One Four Year Old Work Horse.</p>	<p>MISCELLANEOUS ADVERTS.</p> <p>OSCAR GREEN</p> <p>— SELLER OF —</p> <p>FOREIGN AND DOMESTIC</p> <p>WINES AND LIQUORS.</p> <p>HAVANA AND DOMESTIC CIGARS.</p>	<p>MISCELLANEOUS ADVERTS.</p> <p>SELLING OUT! SELLING OUT!</p> <p>NO HUMBUG!!</p> <p>WE WOULD CALL THE ATTENTION OF THE PUBLIC TO OUR</p> <p>WELL ASSORTED STOCK OF GOODS!</p> <p>We keep constantly on hand a large stock of</p> <p>GROCERIES, PROVISIONS, WINES</p>	<p>MEDICAL.</p> <p>HOSTETTER'S CELEBRATED STOMACH BITTERS!</p> <p>PURE AND POWERFUL TONIC.</p> <p>CORRECTIVE AND ALTERNATIVE</p> <p>Of Wonderful Efficacy in Diseases</p> <p>OF THE STOMACH, LIVER & BOWELS.</p> <p>PROTECTIVE PROPERTIES.</p> <p>It cures indigestion, flatulency, and all the ailments of the system which</p>
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Figure 17: *The Green-Eyed Monster in Ivanpah* (Shutka 1962). Other newspapers published in the Preserve area included the *Shaft in Vanderbilt* (ca 1893) and the *Enterprise in Hart* (1908–1909).

“justified” by the courts and Ivanpah Consolidated ultimately paid its debts (Hensher 1984:52; Shumway, Vredenburg, and Hartill 1980:66–68).

When Adam Vale, a photographer from San Bernardino, traveled to Ivanpah in the early 1880s, the town had shrunk to 65 people and mail service came only once a week (Hensher 1984:48). Mineral strikes in the nearby Providence Mountains to the south and the Calico Mountains to the west had initiated a miners’ exodus. Bank failures in San Francisco and Los Angeles, primarily attributed to poor investments in mining operations, also caused a decline in production output (Hensher 1984:44). Although two mills were still occasionally operating in the early 1890s (Crossman 1890:238; DeGroot 1890:531), there were only 11 registered voters in Ivanpah (Hensher 1984:52), with perhaps approximately 25 residents total (Crossman 1890:214). When Frank Williams traveled to Ivanpah in 1892 he found a quiet town and quickly moved on (Warren, Knack, and von Till Warren 1980:216).

New York Mountains

Following the Clark Mountain discovery, prospectors began combing the mountainous regions in the Preserve and several important strikes were made. The New York Mining District was formed in April 1870. Shumway, Vredenburg, and Hartill (1980:72) note that the area is not mentioned in the San Bernardino newspapers until 1873, indicating that the area was so far east it was likely considered part of the Nevada silver discoveries. In 1872 the Elgin Mines Company of Illinois sent a group of prospectors to the New York Mountains, where they rediscovered some previously worked shafts. One shaft was 50 ft. deep and filled with debris, although there was no evidence of machinery or tools. Some speculate that the mines had been originally created by Spaniards several decades prior (King and Casebier 1981:300). The mine was renamed the Montezuma Mine. The following year a 15-stamp mill was erected that produced the first recorded silver bars in San Bernardino County (Brown and Boyd 1922:105; Ingersoll 1904:280; Shumway, Vredenburg, and Hartill 1980:73). Mormons worked the nearby Sagamore Mine in the

1870s. That mine produced silver from rich, narrow veins (VerPlanck 1961:5; Wright et al. 1953:67).

California entered into the national economic arena when the first transcontinental railroad was completed in 1869. After eastern banks failed in 1873, a national depression followed that lasted for several years and greatly affected California’s speculative mining operations. Investments in mining diminished during the remainder of the decade and many mines were shut down. Eventually the economy regained momentum and the completion of the Atlantic & Pacific Railroad through the Mojave Desert between Barstow and Needles in 1883 triggered a renewed interest in the New York Mountain region. Over the next several years, eight silver mines and four copper mines opened in the New York District. Isaac Blake, financier of the Nevada Southern Railroad, purchased the silver mines and named them the New York Group. About 80 men were reportedly on the payroll in December 1893 (Myrick 1963:842).

The Bonanza King

In the spring of 1880, the richest vein of silver yet discovered in California was found at Mount Edgar in the Providence Mountains. The original claim was established by George Goreman and P. Dyer. The ore assayed at \$640 to \$5,000 a ton in silver. A rush ensued and several rich claims were discovered, including one made by Andy McFarlane and Charley Hassen from Ivanpah Consolidated in the Clark District (Hensher 1984:50; Holladay 1987; Shumway, Vredenburg, and Hartill 1980:59). A newspaper report stated that, “Everybody who can get away are off to the mines. The recent discoveries have caused a fever among all the old prospectors and they are away to try their chances once more...” (*Semi-Tropic* 19 June 1880, cited in Hensher 1984:50). By April 1880 the Trojan District was established. Newspapers reported that in 1881, returns from the original discovery were \$251,604.15 for 115 days. Goreman and Dyer ultimately sold their holdings to the Bonanza King Consolidated Mining Company of New York. In 1882 the Bonanza King erected a 10-stamp, dry-crushing mill built by Prescott, Scott, and Company of San Francisco (Holladay 1987;



Figure 18: Providence . *The stone blocks used to construct the buildings in Providence were cut from a nearby ledge. Many of the roofs were created from broken-up whiskey barrels (Dudley and Fickewirth 1941:23).*

Shumway, Vredenburg, and Hartill 1980:59). In 1884 the superintendent report stated that, "The Bonanza King is better opened up, better worked, and we have obtained better results from the ore than any other mine in this great mineral desert. Nearly \$1,000,000 has been taken from the mine in eighteen months and ten days" (Ingersoll 1904:63).

The town of Providence was constructed for workers at the Bonanza King and surrounding mines, and by June 1882 a post office was established. The name *Providence* is thought to have come from early-day travelers because there were several springs in the area (Gudde 1998:302–303). At its peak, up to 300 miners lived at the town (Holladay 1987:E4). The town contained the mining company offices, the post office, two general stores, and several saloons. There was also a deputy sheriff and a U.S. mineral surveyor (Holladay 1987). Initially the Providence range had forested sections of yellow pine, from which the mines and camps benefited (Crossman 1890:520). But because timber was scarce and was primarily needed for shoring up the mine shafts, many buildings in Providence were constructed of the local stone (Figure 18).

By 1884, 110 men were on the payroll at the Bonanza King. During April of that year, two new strikes were made nearby. The ore was processed using the "Boss Process," consisting of conveying the crushed ore through a series of pans, where it is combined with quicksilver (De Groot 1891:532). Mr. E. Huhin was superintendent of the mill, Mr. Callaghan was manager of the mines, and Mr. Morris S. Bates was Secretary and Treasurer of the company. Although storms postponed shipments in 1884, the Belle McGilroy, Mozart, Lucknow, Mineral Point, Treasury, and Morning Star mines were all producing high-grade ore (Chappell n.d.).

While the mines were generating tons of rich ore and a few rich men, laborers were working longer hours with little additional compensation. The 3 February 1885 issue of the *Calico Print* published a letter from a disgruntled miner claiming the operators were "heartless task masters . . . forcing men to work more than health or strength will permit" (cited in Holladay 1987:E4).

In March 1885 the mine and mill shut down. One week later the mine reopened and rehired 15 miners at \$3 a day, \$1 a day less than they were paid

before the closure. Mine owners blamed a drop in silver prices, although the price had only dropped 4 cents an ounce (Holladay 1987; Shumway, Vredenburg, and Hartill 1980:60). Within the next few weeks more miners were hired back although not nearly to the extent as before (De Groot 1891:532). On 31 July 1885 the mill was destroyed by fire. The owners collected the insurance and abandoned the operation. Up until the fire, the Bonanza King produced approximately \$60,000 a month (De Groot 1891:532).

The Trojan District later became known as the Providence District. Other mines in the district included the Perseverance, Dwyer & Gorman, Kohinoor, and the Cook & Thompson. In 1885 a new 5-stamp mill was constructed at the Keer Mine, and there was a proposal to build a 20-stamp mill (De Groot 1891:532). The mill was still in operation in 1890, when approximately 50 people lived at Providence (Crossman 1890:214, 238).

In 1891 the Arrow or Arrowhead District and the Gold Belt, or Goldstone, District had been carved from the Trojan District (Crawford 1894:232). Mexicans were said to work in the area using several arrastras to process the ore (Cloudman, Huguenin, and Merrill 1919:800; De Groot 1891:532). By 1891 the Bonanza King had been developed to a depth of 800 feet. Shortly thereafter the vein played out, yielding only low-grade ore (De Groot 1891:532; Lorey 1986:69). After the 1893 drop in the price of silver, Providence was virtually abandoned until the early 20th century (Crawford 1894:376).

Other Mining Districts

Mescal Mountains

First opened in 1879, the Mescal (or Cambria) Mine was located at the southern end of the Clark District. The claimant, a Mr. Orr, recognized mineralization on the rock cabin in which he was sleeping near the Mescal Spring (Vredenburg 1996a:70). The mine was operative in the 1880s when two tunnels were excavated, each 300 ft. long (De Groot 1890:531). A mill was constructed 1/2-mile away at Mescal Spring in 1886 (Wright et al. 1953:75). The mine and mill produced \$20 of gold per ton of

ore; 15,000 ounces of silver bullion was processed in one month alone in 1887. The associated mining camp was named Nantan and a post office was located there from 1887 through 1890 (Miller and Miller 1976:62; Shumway, Vredenburg, and Hartill 1980:69). The camp was reportedly successful, with “good” pay and generous accommodations consisting of adobes with shingled roofs (Vredenburg 1996a:70). A drop in silver prices forced owner Bill Williams to abruptly shut down operations in 1889 (Bennett 1895).

Ivanpah Mountains

Prior to the gold discoveries of the 1890s, activity on the east slope of the Ivanpah Mountains was limited to the Bullion Mine (Vredenburg 1996a:71–72). Located at the north end of the mountain range, the mine produced silver-lead ore during the 1860s and 1870s; the ore was shipped to Swansea, Wales, for processing (VerPlanck 1961:5). During the 1880s the ore was shipped to the mill at Ivanpah (Shumway, Vredenburg, and Hartill 1980:71).

Vontrigger Hills

Although mostly silver was mined in the Mojave during the earlier years, other mineral potential was assessed, including copper in the New York Mountains and gold in the Vontrigger Hills. The Vontrigger Hills were first prospected in 1858 (Wright et al. 1953:68). Erick Vontrigger, a German-born miner, discovered minerals about nine miles north of Goffs, near self-named Vontrigger Spring. He apparently kept his discovery a secret, occasionally revealing “pouches of gold.” When he died in 1880, the location of his find was still unknown. In the early 1890s, the Exchequer District was formed in the area and prospectors continued to search for the Vontrigger gold in the following years (Shumway, Vredenburg, and Hartill 1980:79). One group nearly perished of dehydration on the quest. Another group operated the “Vontrigger Mines” in 1890, although they were not likely at the same location as the German prospector’s mine. Despite difficulties obtaining water, several mines were producing both gold and silver by 1890, including the Cashier Mine, Exchequer Mine, the

Drednaught, Old Dominion Mine, and the Nonpareil Mine (Crawford 1894:325; Shumway, Vredenburg, and Hartill 1980:79).

Change Comes to the Mining Industry

The Value of Silver and Gold

National and global economics were a key factor in the successes and failures of mineral operations in the West. Because mining involved a combination of several different types of enterprises, economic impacts on mining were multifarious. Although the discovery of minerals could initiate involvement, supply and demand, transportation, and technology were the defining factors in the decision to open up and exploit a specific site or region.

Prior to the Civil War, the United States monetary system was organized according to a bimetallic standard. Silver was in relatively short supply; a silver dollar was worth about \$1.02, at a ratio of 16 to 1 with gold (Figure 19). With the defeat

of France in the Franco-Prussian War in 1871, Germany was paid a heavy war indemnity in gold and switched to a monometallic gold standard. Silver began to flood the market and many countries also changed standards. The East Coast Crash of 1873 caused a national depression, and the United States followed suit when Congress enacted the Coinage Act of 1873, eliminating the silver dollar from the market. Although the impact was not immediate due to an already inflated silver value, prices eventually began to plummet, dropping to 90 cents an ounce by 1878 (Rockoff 1990:750). The silver-mining business joined forces with agriculturists loosely connected as the “Farmers’ Alliances” that eventually developed into the Populist, or People’s, Party. The platform of the Populists included railroad regulation, tax reform, and the unlimited coinage of silver. Their demands eventually led to a compromise measure, the Bland-Allison Act of 1878. In an attempt to undo the effects of the previous Coinage Act, \$2 to 4 million of silver was to be purchased each month by the U.S.

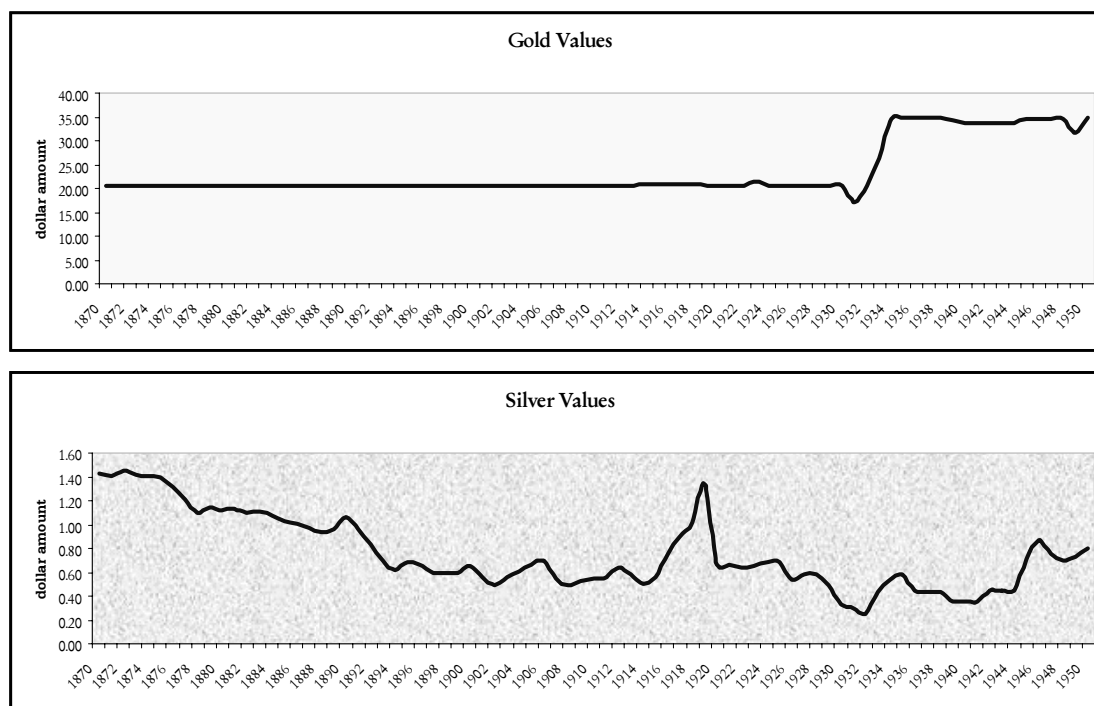


Figure 19: *The Value of Gold and Silver between 1870 and 1950 (information from www.goldinfo.net). The fluctuating value of silver versus that of the more stable gold is clearly illustrated in the above diagrams.*

government. The act provided for the reestablishment of coinage at a ratio of 16 to 1 with gold, but a continued decline in silver prices failed to increase circulation. Financial interests in the eastern U.S. favored the gold standard, while a continuing drop in agriculture values further allied farmers with the western silver-mining business. That group insisted on additional measures, so in 1890 the Sherman Silver Purchase Act directed the government to purchase twice the amount outlined in the Bland-Allison Act. The Sherman Silver Purchase Act drove up the price of silver between 1890 and 1893, when over-supply from the expansive western mining activities would have otherwise caused silver prices to plummet. The measure was repealed by President Grover Cleveland in 1893 after a financial panic prompted a rethinking of national economic policies. Silver prices crashed. Mines were shut down and unemployment peaked at 18.4 percent in 1894 (Rockoff 1990:742). By 1898 silver hit a low of 59 cents an ounce (Amey 2002).

The drop in silver value had varying effects on mining operations in the Mojave. Many mines were devastated and had to close down. There was a revived interest in gold; new discoveries were made and many old silver mines were reopened to assess their gold output (Vredenburg 2005:4). New technologies permitted more complex and complete extraction of gold from the country rock. Other miners had more unique and even illegal ways of handling the economic downturn, as in the Mescal Mine example below. As the century drew to a close, copper and lead production increased, and during World War I tungsten and vanadium were actively sought within the Preserve.

The Mescal Mine Story

In early 1892, the old Mescal Mine was purchased by Spencer and Davis, a pair of Denver businessmen. In an article later posted by the *Los Angeles Times* explaining the story, it was reported that the partners had built a smelter, hired a crew, and installed “unusual” equipment at the bottom of one of the mine shafts (Figures 20 and 21). The following year the U.S. Treasury Department

became aware of counterfeit one-dollar silver coins in circulation. The coins were made of a silver alloy and were created in the exact fashion as those at the government-run mints. They were being packed into hollow bars of silver and sent around the country to be laundered into the mainstream. A Secret Service agent named John E. Bennett began to investigate and ultimately found the source of the counterfeiting operation—the Mescal Mine in the Mojave Desert. After ingeniously gaining access to their camp, Bennett was about to arrest the counterfeiters when Spencer blew a whistle and an explosion went off inside the mineshaft. When brought to trial in Los Angeles, Spencer, Davis and their smelter foreman were all acquitted. The evidence of their counterfeiting operation lay buried at the bottom of the caved-in mine (Bennett 1895).

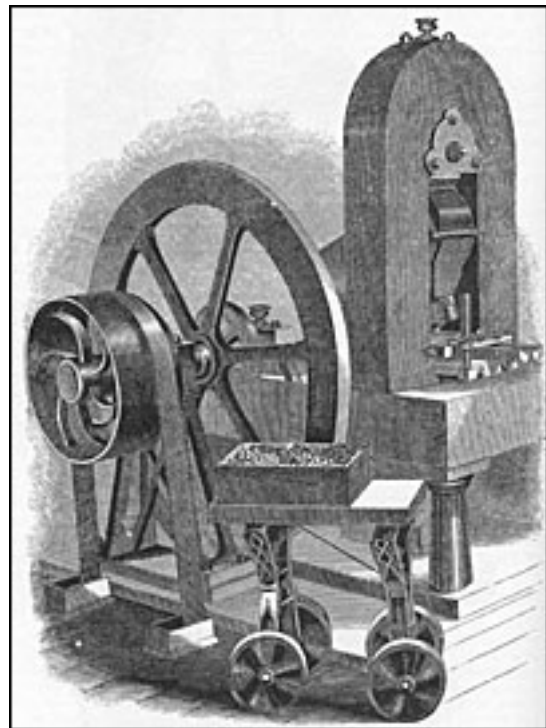


Figure 20: Steam-powered Coin Press (www.fi.edu/pieces/knox/steampower.htm). What type of equipment did the counterfeiters destroy by exploding their mine shaft? They possibly had a coin press like this one. The steam-powered coin press was introduced to the U.S. Mint in 1836 from France and was able to produce 100 coins per minute. Alternatively, Spencer and Davis may have been using a screw-press, a complex machine that took three men to operate.



Figure 21: The Silver Dollar. The Mescal Mine counterfeiters were likely producing these. the Morgan silver dollar. The coin was designed by George T. Morgan and minted in Philadelphia, New Orleans, San Francisco, and Carson City from 1878 to 1904.

GOLDEN YEARS OF MINING IN MOJAVE NATIONAL PRESERVE, 1893–1929

Following the silver crash of 1893, prospectors searched for alternate minerals throughout the region, especially gold and copper. A stable economy, advances in technology, a need for new metals, and improved transportation routes into the area of the Preserve brought about what has been called “The Great Years” for mining in the eastern Mojave (VerPlanck 1961:6). More locations were opened up and successfully mined from the end of the 1800s through World War I than during any other period. The success of the Copper World Mine in the Clark Mountains encouraged railroad construction into the New York Mountains, where there was also productive mining district. Technological advances both for extracting and processing mineral ore accelerated development of the mining industry, and mining boomed throughout the California Desert. New communities sprang up and ranching activities increased in the desert valleys in order to supply the miners and their families. When the United States entered World War I, there was a shift to demands for other types of minerals, such as tungsten and vanadium.

Transportation, Technology, and Vanderbilt

Although the Mescal Mine counterfeiters exploited the remoteness of the Mojave, that isolation was a major obstacle for opening any profitable mining business for most mine operators in the desert. Two transcontinental rail lines, both owned by the same financial investors, were already operating in California by the late 1870s, yet the Mojave remained exceptionally isolated. Eventually competition to create a third line into the state prompted construction of the Atlantic and Pacific Railroad (A&P), which was completed in 1883. That line follows the 35th Parallel route scouted decades earlier by Aubrey, Williamson, and Whipple in the 1850s. Completion of the A&P provided opportunities for development in the Mojave. Miners throughout the area became more easily connected to outside investors, gained access to more materials, and could more easily transport

unprocessed ores and unrefined bullion to large processing plants.

In the early 1890s, Isaac C. Blake from Denver, Colorado began plans for a railroad connecting the mining areas in the New York and Providence mountains to Needles on the Colorado River. Blake, a capitalist and Standard Oil Company executive, envisioned Needles as a milling center, using the Colorado River for power (Murbarger 1957:26). The town was already a service center for the A&P Railroad, which had a hub terminus at that location where steamboats ran up and down the Colorado River. In April 1892 Blake and his partner Warren G. Purdy, vice-president of the Chicago, Rock Island, and Pacific Railway Company, opened a mill called the Needles Reduction Company, and eight months later Blake proposed the Nevada Southern Railway—a short line that led from the Goffs station on the A&P, 30 miles north into the New York Mountains. On 15 December 1892 the Nevada Southern Railway Company was incorporated under the laws of Colorado. Construction began in January of the following year. In anticipation of the approaching rail, Blake purchased the low-producing New York Mine group near the proposed terminus of the line (Myrick 1963:841–848).

From the beginning the project was plagued with problems. Materials were scarce and water had to be hauled in from Needles. Mine owners in the New York Mountains did not financially back the project, as Blake had anticipated, and he had to heavily mortgage each section of line as it was completed in order to begin construction on the next. At the end of each section a town was laid out, including Blackburn and Purdy. Despite the setbacks, grading was complete by March 1893. Tracks were soon to follow and by July the rail line was open. A post office was established at the chosen terminus on the southeast side of the New York Mountains. Blake named the place Manvel, after the then current president of the A&P. In turn, the A&P Railroad renamed Goffs station to Blake (in 1902 both place names were changed, Manvel to Barnwell, while Blake reverted back to Goffs). Crews continued up the slope of the New York Mountains

and the Manvel post office and few businesses moved to the summit. Several months later the line was opened all the way to Vanderbilt on the west side of the range (Hensher and Vredenburg 1987:82–97; Myrick 1963:841–848).

Encouraging Blake in his railroad endeavor, a Paiute Indian named Bob Black discovered gold in 1891, near the place that would later be called Vanderbilt (Figure 22). M.M. Beatty, who became a well-known rancher near Rhyolite, Nevada, was informed of the strike and pompously named it the “great Beatty lode.” Allen Green Campbell purchased shares of the claims from Beatty and renamed it the “Boomerang” (Crawford 1894:230). Campbell constructed a 10-stamp mill, and within a few weeks a mining camp appeared. The camp was named Vanderbilt after Cornelius Vanderbilt II, the famous eastern tycoon (Hensher and Vredenburg 1987:82–92; Murbarger 1957:25). A second system of quartz-bearing veins was found nearby and was named the Gold Bar–Gold Bronze claims. A mill was erected nearby that had been shipped in from Gilpin County, Colorado (Crawford 1894:237).

Prior to the completion of the Nevada Southern, Vanderbilt consisted of a few tents, including a lodging house, a general store, a Chinese laundry, and two saloons. About 200 men were in the area, although only 20 were regularly employed (Shumway, Vredenburg, and Hartill 1980:74). The completion of the railroad and the coinciding silver crash brought miners in great numbers to the New York Mountains. Regular rail service between Blake and Manvel began in August and up to 50 men a day would come looking for opportunity. New businesses were opened and a school district was created—the first one in the region. A mining-district recorder and a justice of the peace were established. By late 1893 the estimated population was approximately 3,000 people in the greater vicinity (Murbarger 1957:26), while the town included up to 400 people (Hensher and Vredenburg 1987:87). The increase in population caused a water shortage. Initially the water had been packed in on burros from Cuddeback Spring, but that water was found to be contaminated. Water was then hauled in from Willow Spring, but that was 3 miles away. Eventually one of the nearby mines dug a shaft that produced good water (Murbarger 1957:26). Mines



Figure 22: *Vanderbilt in the 1890s was an oasis in the desert (Huntington Library from Paber 1980:286).*

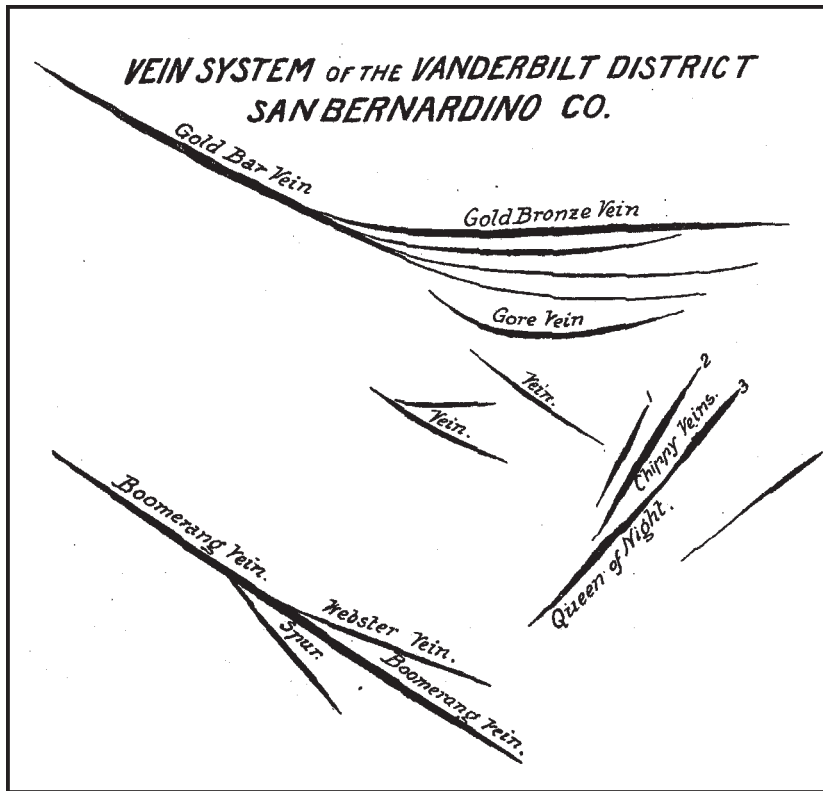


Figure 23: Gold at Vanderbilt (Crawford 1894:236-237). The vein system at Vanderbilt was impressive to the California State Mineralogist in 1894. Two main parallel fissures and a smaller cross-fissure showed striation in the ore body indicating significant earth movement following their original formation and ore deposition.

operating in the area included the Queen of Night Mine, the Chippy Mine, and the St. George Mines (Crawford 1894:237) (Figure 23).

Despite the big discoveries at the Gold Bronze and Boomerang, by September 1893 mining in the Vanderbilt district was on the decline. Mines continued to produce but only a handful of men were employed. Two small mills were opened in 1894, but the boom and rush to the area was already beginning to bust (Crawford 1896:320). Jim Fisk, a hoist operator at the mines in the late 1890s, was interviewed in the 1950s and remembered his time there:

We had a weekly newspaper, *The Shaft*, four restaurants and several boarding houses, half a dozen general stores and about the same number of saloons. Two of these – the Gold Bar and the Whist Club – were open 24 hours a day in approved Wild West style. The Whist Club, which was housed in the town's only two-story building, was

owned and operated by Virgil Earp, one-armed brother of Wyatt, the gun-fighting marshal of Dodge City and Tombstone. The upper floor of the building was used for lodge meetings and dances. We had an orchestra composed of a reed organ and a couple of fiddles, and a group of us organized a theatrical company and presented home talent plays [Murburger 1957:26].

Blake's construction of the Nevada Southern and investments in the Sagamore Mines never paid off. The county sheriff took over the railroad in February of 1894 and the former general manager R.S. Siebert and his partner R.W. Woodbury purchased the bankrupt railroad in 1895. The line was renamed the California Eastern Railway. In order to extend the line from Vanderbilt north into the Ivanpah Valley, the A&P financed the California Eastern in exchange for a 49 percent interest in the stock. The grade was constructed by Bright &

Crandel from San Bernardino, with the help of up to 150 Mohave Indians. Upon completion, in July of 1902, A&P purchased the remaining stock and renamed Manvel to Barnwell. The success of the Copper World Mine in the Clark Mountains stimulated construction of the line north through the New York Mountains to the Ivanpah Valley.

One of the primary factors that caused the decline of the New York Mountain gold mines was the lack of technology to process low-grade ore. Although the use of cyanide to process gold was first discovered in 1890, the new technology was slow to reach the Mojave Desert region. John MacArthur and Robert and William Forrest of Glasgow, Scotland were the first to discover the use of cyanide. In 1890

they introduced the technique to the Witwatersrand gold mines in South Africa, where the demonstration proved that about 96 percent of the gold could be separated from the ore (Figure 24). Cyanidation enabled older gold mines to increase waning production: old tailings from abandoned mines could be reprocessed with portable cyanide plants (Vredenburg 2005:5).

Activity in the Vanderbilt area was in decline by 1896 (Crawford 1896:329). Miner Jim Fisk recalled that,

Vanderbilt was strictly a gold camp. It wasn't a high-grade camp, either, as compared to Goldfield or Bullfrog. It had come to life when amalgamation

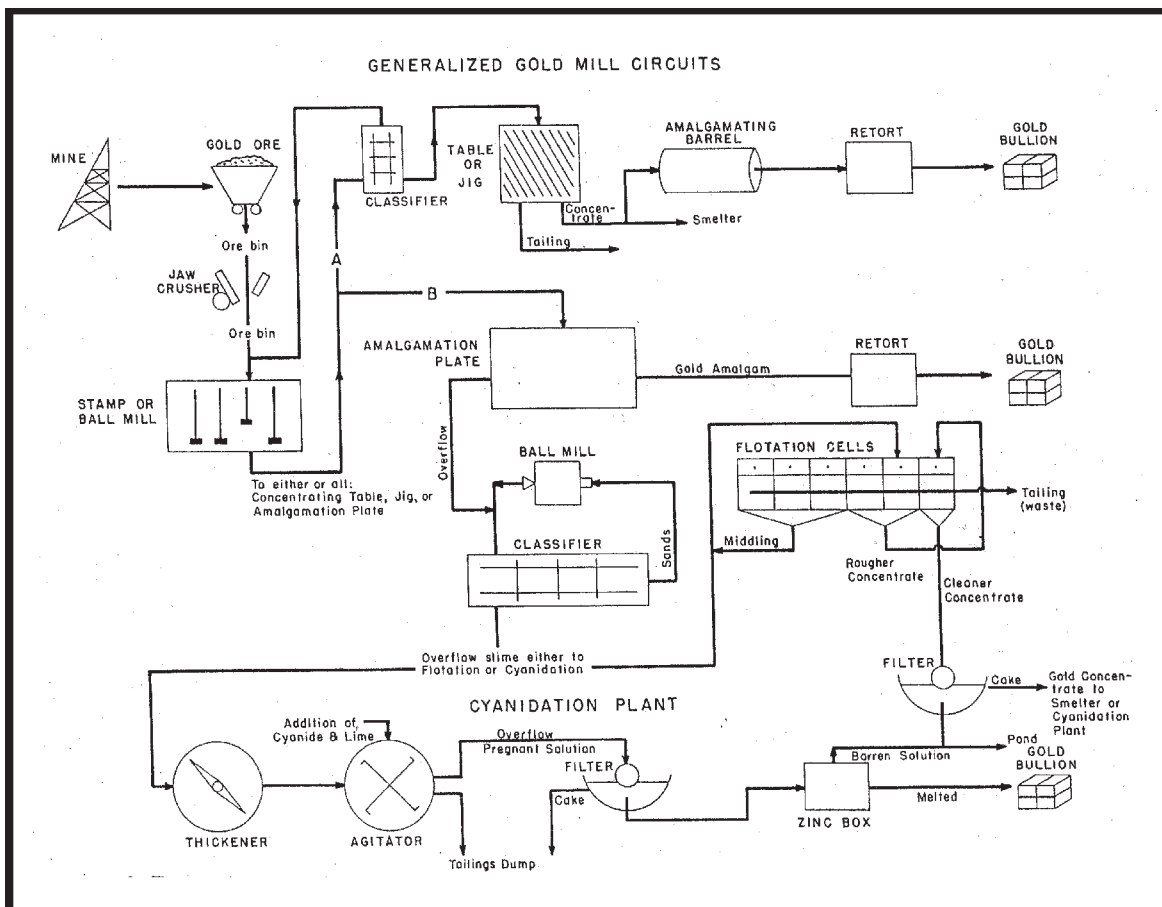


Figure 24: Gold Production (Clark 1957:220). The complicated process of producing gold bullion is illustrated in the above diagram. Although the introduction of cyanide for extracting gold enabled previously ignored low-grade ores to be processed, the equipment and upkeep was costly and difficult to transport. The subsequent environmental degradation from the use of cyanide is a challenge for former gold producing regions, including several locations within the Preserve.

was about the only process known for the treatment of gold ores, and amalgamation is effective only on so-called free gold, that is ore which has been thoroughly oxidized and the gold contained in its sulphides liberated. The oxidized zones at Vanderbilt did not extend to any great depth and soon as the ore was extracted down to the sulphide zones, treatment by the amalgamation process no longer worked. Smelting or concentration – or both – became necessary. The mills at Vanderbilt tried to work the sulphides, but none could do it with success. At last, they simply gave it up as a bad job [Murburger 1957:26–27].

Despite the slump, mining operations continued around Vanderbilt through the 1890s and into the early 20th century. In 1897 the first cyanide plant in the area was built by Karns and Eckins of Manvel (Barnwell) to rework the old tailings of the Campbell Mill (Shumway, Vredenburg, and Hartill 1980:75). Unfortunately the increased activity wasn't enough to maintain the town infrastructure. The school closed in 1898 and the post office was discontinued in March 1900. Mining activity continued though and in 1904 a 10-stamp mill and an air-compressing plant was in operation (Ingersoll 1904:282). A second cyanide plant was built in 1910 in order to process 7,000 tons of ore with an expected \$5 of gold per ton. A 3-stamp mill was erected in 1912.

By 1916 two companies were operating gold mines in the Vanderbilt district. J.Z. Bartnett Mining Company had three developed shafts and the Vanderbilt Development Company had shipped some high-grade ore (Cloudman et al. 1919:816). In 1924 the mill was replaced with a 75-ton ball mill. The population estimated for 1924–1926 was 8 (Hewett 1956:8). Limited work continued into the 1920s and 1930s when several shafts were dug (Wright et al. 1953:83). In 1929 the mines extracted 800 tons of ore that contained silver with smaller

amounts of gold. A 25-ton flotation plant was constructed in 1934. Mining and processing continued intermittently until World War II (Shumway, Vredenburg, and Hartill 1980:76). Brief periods of mining activity occurred in the area during the early 1970s, although the town of Vanderbilt remained deserted.

Copper World Mine

In the late 1880s, when Nikola Tesla began to develop alternating current using copper coils to allow long-distance transmission of electricity, the value of copper soared and a copper rush began. The most successful of these in the Preserve area was the Copper World Mine in the Clark Mountains. Through the first decade of the 20th century, many mines throughout the Preserve produced copper, as well as gold and silver.

In 1898 the old copper prospect of the Clark Mountains was reopened and extensively worked, to become the largest copper-producing mine in southern California at that time (Hensher 1984:53; Myrick 1963:844; Vredenburg 2005:6; Figure 25). The Ivanpah Smelting Company had purchased the mine for \$1,100, and by early 1899 a smelter with a 50-ton water-jacket furnace was constructed at Valley Wells, also called Rosalie (Aubury 1904:254).

At its peak production period between 1899 and 1900, the mine and smelter supported 85 employees. A small camp rose near the smelter and the Ivanpah post office was moved there in 1899. Mule teams hauled 35 tons of ore at a time from the mine to the smelter. Copper bullion was then transported to the railhead at Manvel (Barnwell), 30 miles to the southeast (Vredenburg 1996a:69). Mule teams would pull 20 tons of bullion up and over a 2,000-ft.-high pass through the New York Mountains, returning with coal and other supplies. The smelter produced a 98 percent pure black copper, but a high mineral loss in the slag caused the operation to fail (Aubury 1908:328). This created financial troubles that ultimately shut down the operation in July 1900, despite an output of approximately 11,000 tons of bullion reportedly worth over \$750,000 (Hensher 1984:53). The mine reopened and by 1902, 3,000 ft. of shafts and tunnels

had been excavated. The California Eastern rail line was extended from Barnwell, shortening the wagon haul from the smelter to the railroad. The high-grade ore played out, however, and the mine could not produce enough bullion to continue to operate. The mine ran for a few more months, but financial and legal troubles finally closed the operation down (Vredenburg 1996a:69–70).

Without high-grade ore, the Copper World Mine went into a second phase of operation involving the more complicated processing of low-grade ore. The Cocopah Mining Company resumed operations between 1906 and 1908, producing 243.5 tons of copper ore averaging 6 to 10 percent copper per ton. The smelter had gone into disrepair during the closed years, so the ore had to be shipped to Needles for processing (Aubury 1908:328; VerPlanck 1961:6).

Transportation was monopolized in the area until the Union Pacific's Salt Lake Railroad was completed in 1905. This line went south from Nipton through the area of the Preserve. The junction of the Salt Lake and California Eastern was named

Leastalk. Several new towns grew along the Salt Lake line, including Cima and Kelso (Myrick 1963:841–848) (Figure 26). During the Copper World Mine's decline, the Ivanpah railhead had gone into disuse, and the post office had been moved to Leastalk. The buildings at Ivanpah burned in 1908, reportedly by squatting drifters. Trains stopped running between Barnwell and Ivanpah in 1913. Capitalizing on the familiarity of the name, Leastalk was first renamed South Ivanpah and then later Ivanpah (the third place in the region to have that name). The tracks over the New York Mountains were removed in 1921, and by 1923 the entire California Eastern line was closed down (Myrick 1963:841–848).

Metal demands and a rise in prices during World War I created a rebirth of the Copper World Mine. Reorganized under the name the Ivanpah Mining Company, the mine reopened in 1916 as a part of the Ivanpah Mining District (Hamilton 1921:363). The Valley Wells Smelter briefly reopened, but only produced 2 percent copper per ton of ore (Hamilton 1921:363; Ruff and Unruh 1980:312;



Figure 25: Copper World Mule Team (date of photo unknown; San Bernardino County Museum).



Figure 26: *Railroad engine at Kelso (date of photo unknown).*

VerPlanck 1961:6). Production was shipped to Needles, although this time via the rail stop at Cima. Employment rose from 6 to 60 between 1916 and 1918 (Cloudman, Huguenin, and Merrill 1919:786; Shumway, Vredenburg, and Hartill 1980:70). During World War I, 1,735 tons of copper ore was produced, containing approximately 4 percent copper (Ruff and Unruh 1980:307). The owners also explored and mined the Mohawk Hill Mine, which produced \$70,000 of lead ore in 1917 alone (VerPlanck 1961:6). Both mines shut down at the end of the war due to dropping prices (Hamilton 1921:339; Shumway, Vredenburg, and Hartill 1980:70).

Other Mining Districts

Standard District

The Ivanpah Mountains became an area of concentrated mining activity in the mid-1890s due to improved transportation access and the discovery of several rich gold-copper veins. The Excelsior Mine, discovered in 1898, was very productive for more than two decades. A small mining camp called Nelson's Copper Camp (later the Standard Copper Camp) was located nearby and a 124-ft. shaft was dug. In 1905 the mine was purchased by the Standard Mines Company of Los Angeles and renamed the Standard No. 1 (Casebier 1988:253). The camp, renamed the Standard Camp, was expanded to include a boarding and bunk house, a store, and telephone service (Shumway, Vredenburg, and Hartill 1980:71). Ore was hauled 10 miles to the railroad station at Cima, where it was shipped to Salt Lake City. A total of \$68,000 of ore bearing

copper, gold, and silver was shipped from the mine in 18 months. The mine continued to operate intermittently until 1919 (Vredenburg 1996c:74).

In 1908 the Standard Mines Company No. 2 purchased several more original claims, including the Sextette Group, Dixey, Ritche, Holley, Meyer, and Venice, and operated for a short time in the early 1900s (Hensher and Vredenburg 1987:170). The Morning Star, the Copper King, the New Trail Copper, and the Carbonate were also being worked at that time (Shumway, Vredenburg, and Hartill 1980:71). The Kewanee Mine (originally called the Casa Grande) was worked between 1907 and 1911. A small camp, the Kewanee Camp (originally named Meadsville after discoverers Dr. J.S. Mead and his son) was established nearby. A mill was set up and 50 men were employed at the mine and mill. The Sunnyside mine and camp was also located close by and operated sporadically between 1907 and 1912 (Vredenburg 1996c:74).

Soda Lake

On the western edge of the Preserve area, construction began on the Tonopah and Tidewater Railroad in 1906, with stops at Soda Springs and Baker (Figure 27). The line extended through the immense saline playa of Soda Lake and served the borax mines near Death Valley. This new transportation created interest in the development of the salts that form on the surface of the playa. In 1907 the Pacific Coast Soda Company and the Pacific Salt and Soda Company began constructing plants to extract sulphate of soda, sodium carbonate, and salt. The plants were equipped with narrow-gauge rail lines that extended out onto the playa, acres of evaporation ponds, and equipment for processing (Fulton 2005:55). Salt extraction continued until 1911.

The Tonopah and Tidewater Railroad continued to operate until 1938 (Myrick 1963:545–593).

Kelso District

The old Rock Spring discovery, the Macedonia Mine, was reopened as the Columbia Mine and operated intermittently beginning in 1897 into the 1950s. A mill was erected at the site and operated between 1900 and 1905, in the 1910s, and in 1935 (Shumway, Vredenburg, and Hartill 1980:58). Twelve men worked the mine in December 1900 and the Columbia Mines post office opened in September 1901. By 1902, 20 men were working at the mine, although the post office was shut down in November 1902 (Hensher and Vredenburg 1987:113).



Figure 27: Salt at Soda Lake (Hugh Tolford Collection from Fulton 2005:59). *At the Pacific Coast Soda Company's plant, a small train ran on narrow-gauge rails out onto the playa to transport crusts of saline to the processing plant on the edge of the dry lake. The crusts were crushed and processed through a series of vats to remove sand and sediment. From there the brine was pumped into a settling tank connected with an ammonia ice machine. The freezing temperatures caused the sulphate of soda to settle on the bottom of the tank while the remaining liquid was pumped into vats where the salt could crystallize. The last of the liquid was set onto large solar vats on the playa to dry in the sun, producing an impure sodium carbonate.*



Figure 28: Five-stamp Mill. *Most mills located within the Preserve area had either five or ten stamps, although a few twenty-stamp mills were occasionally proposed. A single stamp weighed between 850 and 2,000 pounds, but stamps heavier than 850 pounds were not recommended for pack animal transportation.*

The Confidence and Francis copper mines were located on the southwest slope of the Providence Range and were also incorporated in the Kelso District. Ore from the Francis Copper Mine was shipped to the Ivanpah Copper Company's smelter at Rosalie (Hamilton 1921:340–341). Gold and silver was processed with a five-stamp mill (Figure 28). Other mines nearby included the Silver Fox, the Copper Bell, the Gold King, or Gold Valley Mine, and the Lost Burro Mine (Lorey 1986:71). The Lost Burro Mine had been discovered in 1908 by D.G. Warfield and Mark Neumayer. They opened the mine and a camp of about 50 tents was laid out nearby. The gold was processed in an arrastra until a stamp mill was erected a few years later. In 1909 the Out West Mining Company operated a mine and small camp near Black Canyon (Shumway, Vredenburgh, and Hartill 1980:62). By 1921 all the operations were idle (Hamilton 1921:340).

Gold, silver, and lead were discovered at the Death Valley Mine on the west side of the Mid Hills in 1906. The following September the mining camp of Dawson developed. Ore was hauled on wagons to Cima and then on railroad to the Needles smelter. Two shafts were sunk, the Death Valley and the Arcalvada. Mining continued intermittently until June 1927, when a fire destroyed the main shaft and

the surface plant. The operations were rebuilt and by 1930 the mining camp housed 100 men (Wright et al. 1953:107).

Providence Mountains

Interest was renewed in the Providence Mountain area during the early part of the 20th century (Shumway, Vredenburgh, and Hartill 1980:61–62). In the Arrow Mining District, Hidden Hill, Bill McKinley, Golden Queen, and the Golden Queen Fraction mines were all working small gold veins. The ore was high grade, with no ore below \$50 per ton shipped out of the area.

Gold was discovered south of the old camp of Providence at the Hidden Hill Mine in 1894. The ore assayed at 54.5 ounces of gold per ton (Shumway, Vredenburgh, and Hartill 1980:61). The area was established as the Goldstone District. Small gold veins were developed in 1894 and 1896. In 1895 a two-stamp mill was erected and through 1901 approximately \$36,000 of gold was mined. In June of 1914 a pocket of free gold was found at the Hidden Hill Mine that produced \$13,000 from 300 pounds of ore (Hamilton 1921:348; Shumway, Vredenburgh, and Hartill 1980:62). According to the State Mineralogist report of 1920 none of the mines were operating at that time (Lorey 1986:69).

After its closure in the 1890s, the Bonanza King Mine was briefly reopened in 1906 and a new 10-stamp mill was constructed. The mines were again developed in 1914, closed in June 1920, and operated intermittently until 1927 (Cloudman, Huguenin, and Merrill 1919:827; Hamilton 1921:361). Other mines in the area included the Pilot Group, the Buena Vista group, the Providence, the Perseverance, or Silver King, and the Confidence mines. By 1924 the population estimate for Providence was 12 people (Hewett 1956:8).

A group of four mines in the Arrow Mining District were mining gold, silver, and copper in 1918 and 1919, including the Contention, Investment, Subway, and Mabel mines. A three-stamp mill, a Standard concentrator, and a gas engine were left at the site. The mines were reopened and expanded in 1923 and 1924 and two men were employed. The mines closed the following year (Hamilton 1921:349; Lorey 1986:87).

Solo District

On the northern side of the Preserve was the Solo Mining District. First mentioned in 1890, the boundaries extended outside modern Preserve boundaries at the Five Point District, Cronise Lake, and Mesquite Springs, down to Marl Springs and Halloran Springs (Crossman 1890:222).

Small ledges of gold were found in the area by 1890 (Crossman 1890:217), but it was 10 years before the first development occurred. Three main veins were worked, each about 200 ft. apart (Wright et al. 1953:78). Operations continued in the area until 1914 (Miller and Miller 1976:53). The Paymaster (or Whitney) Mine was discovered in 1900 and operated between 1910 and 1914. A 10-stamp mill processed the ore by amalgamation, producing \$50,000 to \$100,000 worth of gold (VerPlanck 1961:7). A camp called Seventeen Mile Point, named for its location between Soda Lake and Marl Springs, was established near the mine (Shumway, Vredenburg, and Hartill 1980:44). The mine shut down in 1914, but the area was periodically worked in the 1930s and 1950s (Shumway, Vredenburg, and Hartill 1980:44; Wright et al. 1953:78).

Cima District

The Teutonia Mine was first discovered in 1896. Located on Teutonia Peak near Cima Dome, the mine was reopened in 1906 by Charles Toegel and operated until at least 1910. A small company town named Toegel City was located nearby that had a general store and blacksmith shop, as well as residences for the workers. The mine shaft had caved in by the 1920s (Casebier 1988:254; Vredenburg 1996c:74).

Vontrigger District

Copper ore was developed in the Vontrigger Hills in the early 1900s. In 1907 a pipeline to the “Vontrigger Mine” was constructed from a spring on the north side of Hackberry Mountain, and a significant camp was established (Shumway, Vredenburg, and Hartill 1980:80). Ore averaging 4 percent copper per ton was recovered by a leaching process. By 1913 gold was processed using cyanide and copper with an electrolytic process (VerPlanck 1961:7). The Exchequer Mine was producing ore between 1909 and 1915, with a reduction plant constructed there in 1913 (Cloudman, Huguenin, and Merrill 1919:785).

Discoveries in the Castle Mountains

In 1907, just outside the Preserve boundaries, James Hart and the Hitt Brothers discovered gold in the Castle Mountains (Shumway, Vredenburg, and Hartill 1980:77–78). The three men had previously worked mines in Goldfield, Nevada. Many of the gold seekers came from Goldfield and Searchlight, Nevada and later from as far away as San Francisco and Denver. The Oro Belle was the first claim filed just east of the Hart townsite. This mine remained the most productive in the area. The ore was assayed to contain between \$60 and \$200 worth of gold per ton (Hewett 1956:159–160). George and Will Foster laid out the town of Hart near the discoveries, which soon had a population of 400 (Hensher 1984:38; Miller and Miller 1976:58). In March 1907, a short rail line was constructed between Barnwell and Searchlight and a siding named Hitt was opened to access the milling operations in Searchlight (Halloran and Wilke



Figure 29: *Another View of Hart from a promotional pamphlet (circa. 1908, Larry Vredenburg Collection, San Bernardino County Museum)*

1987:5). During the first years of production, Hart and the Hitt brothers were sending their ore to Searchlight for \$3 per ton (VerPlanck 1961:7).

By 1908 the town of Hart had three hotels, a post office, a general store, a justice of the peace, a newspaper, *The Enterprise*, and a population of about 600 to 700 people (Miller and Miller 1976:58; Shumway, Vredenburg, and Hartill 1980:77) (Figure 29). Water was tapped through a pipeline from Barnwell. During the winter, when the pipe froze, water was hauled by wagon from French's Spring 6 miles away (Miller and Miller 1976:58). In 1909 Hart along with George Foster, owner of the Big Chief mine located about 1 mile south of the Oro Belle, bought and erected a "Little Giant" 10-stamp mill. The foundation was not properly constructed so it had to be shut down. New foundations were laid and the mill was in operation by November 1909. The mill, which used the cyanidation technique (VerPlanck 1961:7), probably serviced other mines in the area, including the Green Gold and the Jumbo.

Later called the Valley View Mill, it operated intermittently between 1909 and 1951.

A fire destroyed much of the town of Hart in 1910 (Shumway, Vredenburg, and Hartill 1980:78). Water was so far away that the fire was left to burn out of its own accord. Mining continued despite the fire, and in 1911 the Oro Belle drilled a well. A 50,000-gallon water tank was erected and a 25,000-gallon water tank was built at the mine, with a 4-inch pipeline connecting the two. Plans included a water-powered mill, but it was not built. The Oro Belle was sold to a Philadelphia company in 1908 for \$100,000 (*Needles Eye* 7 November 1908, cited in Snorf 1991:60). The Oro Belle operated intermittently between 1909 and 1918, when it was closed (Snorf 1991:59). The post office closed at the end of 1915 (Durham 1998:1426).

World War I and New Mineral Discoveries

Tungsten and vanadium are important minerals for the production of alloy steel, a combination of iron with another metal. Steel was

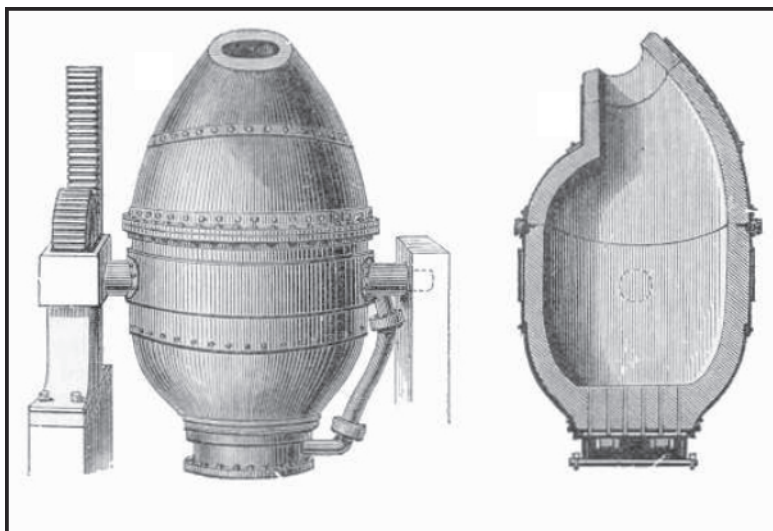


Figure 30: Bessemer Converter (Routledge 1900). *Sir Henry Bessemer, an English engineer and inventor, based the design of his converter on a practice used in China as early as 200 A.D. The procedure involves the removal of impurities from the iron by oxidation or air blown through the molten iron. Oxidation also raises the temperature of the iron and keeps it from hardening.*

expensive and difficult to make, until in 1856 Henry Bessemer introduced a new way of producing the metal. A special furnace called a converter could be used to combine iron with minerals like tungsten or vanadium to create cost-effective steel in larger quantities (Figure 30). In addition, steel made with those additives is self-hardening and wear resistant. Demand soared during World War I, when steel alloy was used to manufacture weapons, tanks, and ships for the American military. Tungsten was also used in the filament wire of incandescent light bulbs, which resulted in less-expensive light-bulb production. Furthermore, tungsten was used in the tubes of two-way radios, which allowed soldiers separated by distance to communicate with one another.

Several tungsten discoveries, which were heavily exploited during World War I, were made throughout the Preserve. In the Clark Mountain District, the Mojave Tungsten Company owned 10 patented claims that were producing a high-grade ore with 30 percent tungstic oxide. Twenty men were employed in 1916 and a concentration plant was completed for processing (Cloudman, Huguenin, and Merrill 1919:839).

The Confidence Mine in the Providence Mountains produced tungsten in the early years of World War I, but the mine closed in the summer of

1916 (Cloudman, Huguenin, and Merrill 1919:849; VerPlanck 1961:7).

The Sagamore and Garvanza mines in the New York Mountains were producing tungsten during World War I (VerPlanck 1961:7). The Sagamore (formerly the New York Group owned by Isaac Blake of the Nevada Southern Railroad), which had been mined in the early 1890s, had been idle for many years until the discovery of tungsten reopened the mine. A small mill was erected and 15 men were employed in 1916 (Cloudman Huguenin, and Merrill 1919:790). The mine closed in 1917 (Shumway, Vredenburg, and Hartill 1980:74). The Garvanza Mine was located on the north slope of the New York Mountains. It was first explored in 1905, and began producing silver, gold, copper, and lead, as well as some molybdenum and thorium by 1907 (Shumway, Vredenburg, and Hartill 1980:76).

Other tungsten producing mines in the New York Mountains included the Carbonate, Ruby, Lucky Strike, North, Ella May, and Oversight in the Carbonate Group, all located near the Garvanza mine and mill. The Tungsten King Group of mines were located on the south slope of the mountains but lack of water was problematic (Cloudman Huguenin, and Merrill 1919:842).

The Signal District was very active during World War I, producing tungsten and vanadium. Several mines were operating, including the Argosy

Mine and the J.C. and W.O. Kinsman mines. H. I. Reynolds of Boulder, Colorado commissioned the Reynolds Custom Mill at Goffs in the spring of 1916. It was claimed that it would process up to 25 tons of ore in 24 hours. The mill only operated for a few days before closing because it was not effective (the ore was crushed too coarsely). The Signal Mining District also included Signal Hill and Homer Mountain. The Leiser Ray mine opened in 1891. The mine was very active during World War I, when it produced 13,600 lbs. of copper, 960 lbs. of lead, and 400 oz. of silver (Nielson et al. 1987:C5).

The Signal District was the only producer of vanadium in California by 1919. Operations were at the Lombard and Main Mine and the Louisiana California Mining Company's Leiser Ray property. The vanadium deposit was discovered at the Leiser Ray in 1902; attempts to mine the resource were not successful, although the company even erected a 50-ton mill to process the ore in 1916 (Cloudman Huguenin, and Merrill 1919:852; VerPlanck 1961:7).

During World War I, a barite deposit was worked at Foshay Pass in the Providence Mountains (Hamilton 1921:334). Barite is the main ore of barium and is used in the manufacture of paper, glass, and rubber.

GREAT DEPRESSION MINING IN MOJAVE NATIONAL PRESERVE, 1929–1941

Following World War I, mining continued in the Preserve area at a smaller scale until the events of the Great Depression caused a renewed rush to the area. Many mining operations opened up, although most were relatively small scale and often family run. Many miners took advantage of previous mining operations, reusing shafts, adits, and surface features, and almost always re-processing old tailing and waste-rock piles (Smith 2006).

Small-scale Mining in the Preserve

The Great Depression, beginning in 1929, had a rippling effect on all aspects of life within the United States. Banks failed, industry froze, and people lost their jobs. Individuals and families

desperately searched for work. Mining operations were generally on a smaller scale, including many family-operated mines. In 1930 approximately 500 people inhabited the area of the Preserve (U.S. Census 1930). The state's gold production increased from \$8,506,703 to \$10,708,000 between 1929 and 1931. The economy continued to worsen until the programs of the New Deal assembled by President Franklin D. Roosevelt caused a turning point. In October of 1933 Roosevelt introduced a plan for the government to purchase gold. Prices continued to decline, so the value of gold was artificially increased by passage of the Gold Reserve Act of 1934, when it was revalued from \$20.67 to \$35 an ounce (Gardner 1954:51). Silver was also artificially valued and purchased by the government according to the provisions of the 1934 Silver Purchase Act. Mining in the Mojave was fueled by those high mineral values and high national unemployment, almost 25 percent at its peak (Figure 31).

Many miners during the Depression did not have mining experience or formal training and lacked the geological background and business experience necessary to prospect and open up a mineral operation. Furthermore, unlike miners in the past, many men now brought their wives and children to open family-run operations of just a few workers. Depression-era miners relied heavily on landscape elements left behind by their predecessors, making use of this "inherited" landscape to organize their operations. Anything that could be reused, especially major infrastructure such as roads and water-supply systems. Shafts and adits were re-explored and almost all tailing piles were reworked using improved cyanide techniques to extract the gold. Adits were refit with shelves and screens to be used as shady storage areas. Any extant buildings were reoccupied and old dumps and privies were reused (Smith 2006). The strategy worked, and many mining operations were profitable. Just before the United States entered World War II, mineral production county-wide was at its highest point since 1857 (Clark 1957).

Mines during the Depression Era

At the Solo Mining District on the north side of Old Dad Mountain, several mines were opened during the late 1920s through the 1930s. The Brannigan Mine was worked from 1928 to 1935; several thousand tons of gold ore, worth up to \$110 per ton, was extracted (Wright et al. 1953:72). The Oro Fino Mine, first discovered in the 1890s, produced about \$50,000 worth of gold by 1943 (Shumway, Vredenburg, and Hartill 1980:44; Tucker and Sampson 1943:457).

Near Halloran Springs, Ralph and A.A. Brown of Utah discovered the Telegraph gold vein in November 1930. Gold was assayed at \$800 per ton (Miller and Miller 1976:53; VerPlanck 1961:7). The Arrowhead Gold Mining Company and the Death Valley Mines Company established and re-opened some of those previously worked mines in the area (Miller and Miller 1976:53).

During the depression, the Kelso Mining District included several mines, including the Columbia, Silver Old, Golden Legend, Silver Queen, and the Comanche. Operations at the Comanche Mine were unsuccessful. Emory Hoerner, son of

miner Oscar Hoerner, stated in an interview that “silver, gold, pyrites of iron, lead, zinc, and gold” were found at the Silver Queen mine (Stein and Warrick 1979:218). The ore was processed with an arrastra, which was built in 1934 or 1935 and was powered by a car engine.

The Rex Mine was located approximately 3 miles southeast of Kelso. Miners worked there sporadically from the early 1930s to the early 1950s. A small mill was on-site and miners excavated two shafts. It appears to have been a family-run operation during at least some of its history. As an example of miners reusing the landscape, the Rex Mine operators reused old railroad cars as residences (Langan 2004). At the Vontrigger Mine operated by the California Gold and Copper Company, 3,729 tons of copper ore was extracted between 1926 and 1929. The Dutch Oven Mining Company opened the mine again between 1944 and 1945 and shipped about 1,200 tons of ore with a 3 percent copper content (Wright et al. 1953).

Just outside Preserve boundaries on the east side of Clark Mountain, the Desert Antimony Mine operated intermittently from 1927 through 1939. It



Figure 31: *The Many Faces of the Mojave. Children and adults of African American, Euroamerican, Hispanic, and Native American descent lived, worked, and played in the Eastern Mojave (Barnwell circa. 1930; San Bernardino County Museum).*

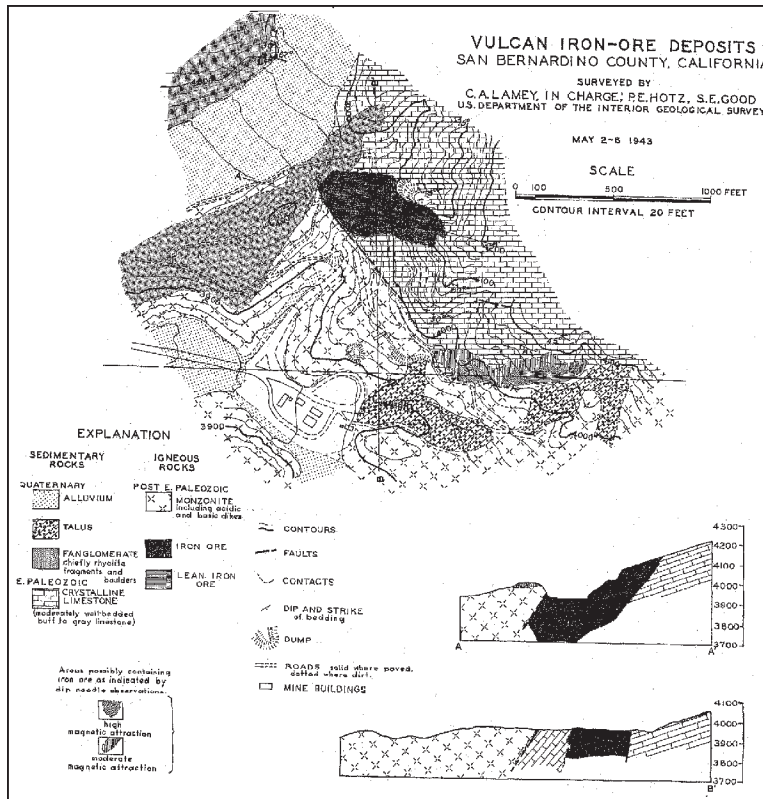


Figure 32: Iron-Ore Deposit (Lamey 1944:88). The Vulcan Iron Mine is a contributing resource of the Kelso Historic District, listed on the National Register of Historic Places in 2001. At the height of mining activity during World War II, the population of Kelso was approximately 2,000, many of whom were employed by the mine.

was the only producer of antimony in San Bernardino County. Three parallel veins were worked and the ore was processed on site (Wright et al. 1953:60).

In the Standard Mining District, the Morning Star Mine was active in 1940, employing 10 men (Bradley 1940:71). A magnesite deposit was mined at the New Trail (Cima) deposit on the east side of the Ivanpah Mountains. The deposit was located on the property of the New Trail copper mine and produced several hundred tons of magnesite in 1918 and the early 1930s (Wright et al. 1953:184).

High unemployment also triggered out-of-the-ordinary gold fever. In the early 1920s, Earl P. Dorr claimed he discovered a “swiftly flowing river deep under the mountain and lining the banks were sands rich in gold” at Crystal Cave, a 3,000-ft. deep cave on Kokoweef Peak in the Ivanpah Mountains. He published an affidavit in the California Mining Journal hoping to find investors for development of the discovery. Herman Wallace, a Los Angeles investor, financed the prospector. Crystal Cave was not on Dorr’s land, so he reportedly blasted a secret

passage leading to the river of gold so that no one else could find it. Just before World War II, prospectors found a vein of zinc and the Crystal Cave Mining Company began focusing their attentions on that mineral, despite pleading from Dorr for more funding to find the gold. The river of gold was never found, although the search still continues (Miller and Miller 1976:62; Weasma 2006, pers. comm.). Although gold has yet to be discovered here, during the 1970s Robert Reynolds of the San Bernardino County Museum uncovered a deposit of Pleistocene-era faunal remains in the cave, including brush ox, dire wolf, large and small camels, horses, marmots, bats, shrews, and birds (Vredenburg 1996c:73).

MINING IN MOJAVE NATIONAL PRESERVE DURING WORLD WAR II AND BEYOND, 1941–PRESENT

Legislative restrictions enacted in World War II forced many mines in the Preserve to abruptly stop operating. War-essential minerals were actively pursued. A large iron deposit was exploited, and

old tailings were reworked using finer processing methods. After the war, mining for precious and base minerals slowly began to regain momentum. Clay and cinder mining became important industries, and just outside park boundaries, one of the largest rare-earth mineral deposits in the world began to be developed. Beginning in the 1960s until the establishment of Mojave National Preserve in 1994, several substantial mines operated in the area.

Executive Order L-208

On 8 October 1942 the War Production Board issued Executive Order L-208, which stopped all non-war-related mineral production in the United States. Gold- and silver-mining operations throughout the West ground to a halt (Clark 1957). At the same time, mining for iron, tin, tungsten, and other base metals—all crucial to the war effort—expanded throughout the Preserve. The Vulcan Iron deposit, first patented in 1908, was located approximately 9 miles southeast of Kelso (Figure 32). A 100-ft.-long tunnel had been excavated but the cost of expansion was too high and the mine was closed (Shumway, Vredenburg, and Hartill 1980:62). In 1921 the California State Mineralogist Fletcher Hamilton noted that “iron ore deposits of San Bernardino County will eventually become of importance both on account of exhaustion of high-grade ores in the eastern section of the country and because of the necessity for supplying the growing demands of the Pacific Coast” (1921:352). When Order L-208 was issued, the Kaiser Company of Fontana, California re-opened the Vulcan. Up to 65 men lived in a camp near the mine and an additional 35 men and their families lived in trailers near Kelso. The operations were able to produce up to 2,500 tons of ore a day. Approximately 43 percent of the ore was mined in an open pit. The remaining ore could only be mined using underground methods and was therefore considered unobtainable. The ore was crushed on location and trucked on a paved road to the Kelso Depot (Lamey 1948; Hensher and Vredenburg 1987:172). More than 2,000,000 tons of iron ore was produced between 1942 and 1948. When the Eagle Mountain Iron Mines in Riverside

County were opened in 1948, the Vulcan Iron Mine closed down.

The Evening Star Mine in the Standard Mining District produced tungsten and tin between 1939 and 1944 (Figure 33). An original shaft was dug at the location sometime between 1900 and 1910 although no production was recorded. Allegedly, John Riley Bembry first discovered tin at the location in 1936. Bembry, a native of Texas, moved to the Mojave in the 1930s and had several claims and a small processing lab on the eastern slope of the Ivanpah Mountains (Ausmus 1989:115–119). He claims to have acquired Evening Star property in 1935, after which he immediately sold it to Trigg L. Button and Clarence Hammett. They began operations in 1938. After several more changes in ownership and operators, Steel Sales and Service Company owned by Carl F. Wendrick purchased the mine in 1943 (Thompson 1978:61–3). Wendrick constructed a mill at Windmill Station, where over 400 tons of ore was processed (VerPlanck 1961:7). The mine closed in 1944. West of the Evening Star Mine, claims were leased to W.W. Harman between 1939 and 1940. Approximately 1,000 tons of tungsten ore was shipped from those claims to the mill at Windmill Station (Vredenburg 1996c:74).

During World War II, several thousand tons of unprocessed crude ore from the Copper World Mine was shipped to the smelter at Valley Wells for treatment (Wright et al. 1953:63). The Mohawk Mine was also reopened in 1942, where lead and zinc were produced (VerPlanck 1961:7).

Mining after World War II - Nonmetallic Minerals

Congress lifted Order L-208 on 1 July 1945 and mining slowly gained momentum throughout the Preserve, although it never reached its former level of activity (Clark 1957). Mining for gold, silver, and base metals occurred periodically, while mining for nonmetallic minerals such as cinder and clay became an important industry.

Small mining ventures operated throughout the Preserve through the second half of the 20th century, such as the Rainbow Wells Mine located at



Figure 33: Evening Star Mine. *This headframe is an impressive structure that could potentially serve as an interpretive station for Preserve visitors. In the mid-1930s the mine was owned by J. Riley Bembry, who claims to have been the first to discover tin ore at the site. Bembry lived and mined in the Mojave Desert for at least 50 years. Born in Oklahoma in 1899, he served in the U.S. army during World War I. After his first visit to the eastern Mojave sometime in the late 1920s or early 1930s Bembry apparently caught “gold fever” and began establishing his residence within the Standard Mining District in the Ivanpah Mountains. He was not a permanent resident until the early 1960s, and because he had built on BLM land, he was allowed to reside there for a small fee but was never granted title. His over 60 mining claims were inherited by his daughter when he died in 1984.*

the southern end of Cima Dome. Men mined for both gold and silver at the site and operated a small processing plant and assay lab. Other mining locations included several formerly productive areas, such as the Vanderbilt area and the Bonanza King Mine.

In the 1920s clay deposits were discovered near Hart on the southwest slope of the Castle Mountains. The C-1 Hart Clay Quarry was opened by H.F. Coors in 1921 and the Standard Sanitary Manufacturing Company mined clay from 1928 through the 1950s (Shumway, Vredenburg, and Hartill 1980:78). At that location, clay was initially removed in a series of underhand stopes or tunnels excavated into the hillside. Beginning in the late 1940s, the clay was excavated by open-pit methods (Snorf 1991:193; VerPlanck 1961:7). A clay deposit was also developed on the western slope of the Mid Hills (Dietrich 1928:195).

Several limestone deposits have been developed throughout the Preserve, but the distance to the major market and the harsh desert conditions have limited production (Gray and Bowen 1980:150). The Clark, Mescal, and Ivanpah ranges contain large limestone and dolomite deposits. The Cima Limestone Deposit, approximately 10 miles north of Cima on the western side of the Ivanpah

Mountains, is comprised of 10 claims equaling about 1,380 acres. By 1931 only assessment work had been done at the location. The area was still idle in 1943. The Standard Limestone Deposit, two miles northeast of Ivanpah had a 30-ft. shaft by 1931. The New York and Providence mountains also contain significant limestone deposits. Southeast of Kelso there has been some exploration and development. A marble deposit was nominally developed approximately four miles southwest of Barnwell. Limestone deposits have also been explored in the Kelso Mountains, on Old Dad Mountain, and near Devils Playground (Gray and Bowen 1980:150–161; Tucker and Sampson 1931:385–389, 1943:521).

Production began at the Cima and Aiken cinder mines in 1954 (Wilshire et al. 1987:B4). Cinders are obtained by blasting and then bulldozing the rubble onto a conveyor belt. They are then crushed, screened, and sorted according to color and size (United States Bureau of Mines 1985:8). Cinder is used as a lightweight building block and for decoration. The mines produced up to 1.5 million tons of cinder between 1954 and 1983. The Cima Cinder Mine continued to operate with temporary permits until 1999.

Mountain Pass Mine operated by the Molybdenum Corporation of America is the largest producer of rare-earth elements in the world and the only producer located in the United States. The mine was discovered during uranium explorations in the late 1940s. Rare-earth elements are minerals with similar properties that are grouped together and collectively called “lanthanides.” The lanthanide deposit at the Mountain Pass Mine contains approximately 40% calcite, 25% barite, 10% strontianite, 12% bastnasite, 8% silica, and minor amounts of other minerals. Rare earth minerals are used in a wide range of industries, including electronics, gasoline production, and medical equipment. The mine operations continue at the present time.

Explorations for oil, gas, and geothermal energy have been conducted throughout the Preserve, although no substantial deposits have been found (Bureau of Mines 1985:11; Howard et al. 1987:C9). A uranium deposit was located in the New York Mountains in 1909 although it was never developed.

Large-scale Operations in the Modern Era

During the second half of the 20th century, mining in the Preserve area was characterized by sizable, well-funded operations extracting large tonnage of low-grade ore. Previously mined tailing piles, as well as mines earlier thought to have an unprofitable mineral-to-ore ratio could be developed, owing to the advancement of cyanide heap-leaching techniques. The process can separate microscopic amounts of gold. Crushed ore is placed on leach pads and covered with a dilute sodium-cyanide solution that filters the mineral particles into a collection system, which drains to a solution pond. The solution is then pumped to a processing plant where the gold is separated. Rising gold values also spurred development. Due to international pressure and rising inflation because of the Vietnam War, Richard Nixon devalued the United States dollar in 1971, causing the price of gold to soar.

Mines in the Preserve during the last quarter of the 20th century included the Morning Star Mine, the Colosseum Mine, and the Castle Mountain Mine.

The Morning Star Mine in the New York Mountains was originally opened in 1907 and was periodically worked until World War II. The Vanderbilt Gold Corporation purchased the mine in 1964 and began operations in 1979. Ore was hauled to a mill located at the former Vanderbilt townsite. The mill was converted to a cyanide carbon-in-leach operation in 1983. The following year a heap-leach facility was built and the mine was converted to an open-pit operation. A second heap pad was constructed in 1987. Although effective—producing 10,000 ounces of gold and 15,000 ounces of silver in 1987 alone—the process violated several environmental standards, including bird and mammal deaths in the cyanide ponds and the leaking of cyanide solution from one of the heaps into an adjacent drainage. The mine was closed in 1993 and a clean-up and abatement order was issued to the Vanderbilt Corporation and Mojave National Preserve by the State of California, Regional Water Quality Control Board (Harding ESE 2002; Vredenburg 2005:75–76).

Near the former townsite of Hart, the Castle Mountain Venture of the Viceroy Resources Corporation of Canada was an open-pit gold-mining operation that was ultimately worked in the early 1990s and was, for a short time, California’s third largest gold mine (Figure 34). In order to receive the permits to operate the mine, Viceroy prepared a Environmental Impact Statement/Environmental Assessment Report, helped The Nature Conservancy create a 150,000-acre Desert Tortoise preserve, bought 745 acres of prime tortoise habitat for the BLM as mitigation for building its mine and access road, and contributed \$2 million to an environmental enhancement fund administered by the Trust for Public Land for restoration. The mine was ultimately excluded from the land area designated as the Preserve.

Since the creation of the Preserve, no open-pit mining activity has occurred within its boundaries. Although there are numerous claims, the process to receive a mining permit is complex and none have fully gone through the process to receive a mining permit from the National Park Service.



Figure 34: Castle Mountain Gold Mine. The scar left by the open-pit mining operation may not heal, but a third-party Environmental Impact Report produced for the project is considered by regulating agencies to be one of the most comprehensive for the evaluation of hard-rock mining operations. The Bureau of Land Management and other government agencies, project promoter: the Viceroy Corporation, and several environmental groups were all able to come to an agreement about mitigation measures prior to any development.

USING THE FRAMEWORK

Many mines were not worked merely once: most mineral locations were discovered, worked, and abandoned, only later to be re-opened, re-worked, and abandoned again, often several times over. Second, third, and fourth phases of mining reused shafts and surface plants of previous operations, sometimes altering and sometimes destroying the evidence of those earlier events. The above framework must therefore be thought of as fluid; mining locations can easily fall into more than one context. For example, despite economic setbacks, silver continued to be mined during the gold and copper heyday of the late 1800s and early 1900s. Furthermore, many mines produced more than one mineral. The framework provides a backdrop, but each individual mine has its own story to tell—about the people and processes that

occurred at the site. Whether silver in the 1870s and 1880s, gold and copper in the 1890s and early 1900s, base metals during World War I, small-scale operations during the Great Depression, iron during World War II, nonmetallics following the war, or large-scale open pits of the second half of the 20th century, mining in Mojave National Preserve created a landscape and history that is recognizable and that continues to impact the area to this day. From the individual prospector with his pickaxe to the complex cyanide leach pads of the modern era, mining has shaped the western United States, California, and the Mojave Desert. Its history can illuminate the struggles and successes of a hardy people searching for riches in a harsh and unforgiving land.

THE ARCHAEOLOGY OF MINING

The history and archaeology of mining has become an important focus for understanding the settlement and development of the United States. Large mining complexes have traditionally been in the spotlight, although smaller sites can also provide valuable information about mining phases in a region. Because of the often-temporary nature of many mining operations, small sites have often been overlooked or misunderstood. In an attempt to highlight the importance of recording smaller, transitory sites as well as established locations, the U.S. Department of the Interior published the *National Register Bulletin—Guidelines for Identifying, Evaluating, and Registering Historic Mining Properties* (NPS 1992). This document provides in-depth technical assistance for recording mining sites and evaluating their eligibility to the National Register of Historic Places (NRHP).

An additional resource for documenting and evaluating mining sites is the National Park Service Western Archeological and Conservation Center (WACC) publication *Guidelines for Archeological Recording and Evaluation of Abandoned Mining Properties* (Cowie et al. 2005). This comprehensive document presents cultural resource managers with guidelines for investigating and evaluating mining properties within the desert lands of five national park, preserve, and recreation areas in the Southwest, including Mojave National Preserve. The report includes sections on general mining history in the West, mining technology, the history of mining in the five NPS units, guidelines and sources for further historical research on mining in the parks, and techniques for recording and evaluating mining properties. Also included are an extensive glossary and bibliography, and a guide to mining-related databases. Each NPS unit was also provided with a set of mining-related documents and maps relating to its specific area. Special attention was given to the Preserve and Death Valley National Park—areas where the least research has been conducted. An example of a historical background report, focusing on the Standard Mining District in the Preserve, is

provided as an appendix. A sample evaluation of the Copper Mountain Mine in Lake Mead National Recreation Area is also provided.

Several historic-period mining sites within the Preserve have been documented by archaeologists, BLM employees, NPS employees, or other qualified individuals. A handful of these sites have been extensively recorded and subsequently evaluated for their eligibility to the NRHP.

RECORDED AND EVALUATED MINING RESOURCES IN THE PRESERVE

The San Bernardino Archaeological Information Center (SBIC) is one of 12 centers of the California Historical Resources Information System, a repository for information and documentation on California's cultural resources administered by State Office of Historic Preservation. The SBIC is located in Redlands, California at the San Bernardino County Museum. Prehistoric and historic-period resources receive a primary number with the county-specific prefix of P36. Archaeological sites also receive a trinomial number with the prefix CA-SBR. Each resource is plotted on a U.S. Geological Survey 7.5-minute topographic quadrangle map and has a corresponding file that includes information on that resource. The SBIC dataset includes information on over 80 mining-site locations within the Preserve (see Appendix A). Several of those sites, discussed below, have been extensively recorded and evaluated for their eligibility to the NRHP (Table 3).

In 1982 Robert E. Reynolds of the San Bernardino County Museum Association recorded and evaluated nine historic sites near the Colosseum Mine in the Clark Mountains. The mine was active beginning in the late 1870s and continued operations sporadically until Executive Order L-208 shut it down in 1942. The sites were evaluated and were considered not eligible for the NRHP (Reynolds 1982).

**Table 3. Mining Sites in Mojave National Preserve
Formally Evaluated for the National Register of Historic Places**

Site Name	State Designation	Researcher	Year Evaluated	Potentially Eligible for the NRHP?	Under what criteria?
Colosseum Mine	CA-SBR-4876H	Robert E. Reynolds	1982	no	A, B, C, D
Rainbow Wells Mine	CA-SBR-10267H	WACC	1999	no	A, B, C, D
Standard Mining District	CA-SBR-769H CA-SBR-10935H-44H	WACC	2002	yes	B, C, D
Rex Mine	CA-SBR-11275H	WACC	2004	yes	C, D
Ivanpah Townsite and Millsite	CA-SBR-2978H	Chapman, Ozburn, and O'Brien	2004	yes	A, D
Columbia-Macedonia	??	WACC	2000	no	??

Just outside Preserve boundaries, a series of cultural resource studies were undertaken prior to the development of the Castle Mountain Venture (Hallaran and Wilke 1987; Wilke 1987a, 1987b; Wilke, Schroth, and Swope 1986; Wilke and McCarthy 1987a, 1987b; Wilke and Schroth 1987, 1988a, 1988b). The 2-square mile area was deliberately not included within Preserve boundaries for the purpose of mining. The Hart townsite, surrounding historic-period mining sites, and prehistoric resource areas are located in the tract. Initial archaeological investigations concluded that the Hart townsite and the Valley View Mine and Mill were potentially eligible for the NRHP.

In 1987 the Valley View Mine and Mill was more extensively recorded and further evaluated. Activity began in the area during the boom years of Hart (1907–1913) and continued intermittently until

World War II. The Valley View was initially found to be potentially eligible for the NRHP under Criteria A, B, and D (Wilke, Schroth, and Swope 1986). Upon further evaluation, it was determined that the site's features lacked sufficient integrity for listing (Hallaran and Wilke 1987).

The Rainbow Wells Mine was formally recorded and evaluated by WACC of the National Park Service in 1999. The site was given the designation CA-SBR-10267H. The project was undertaken to determine site eligibility to the NRHP prior to a hazardous-waste clean-up effort. Research determined that the mine was in operation during the second half of the 20th century. Only one feature, a concrete slab with the inscription "1949," was found to be older than 50 years. The site did not meet any of the criteria for eligibility nor did it retain sufficient integrity (Wilson 2001).

WACC recorded and evaluated the Columbia/Macedonia Mine in 2000 (Cowie et al. 2005:48). The Macedonia Mine was the first recorded mining location within the Preserve boundaries. Twenty seven features were recorded at the site. Most of the features and artifacts appeared to date to the early to mid-20th century. The complex was evaluated as not eligible for the NRHP (Bergstresser 2002).

In 2002 in the Standard Mining District on the Striped and Ivanpah mountains, WACC recorded 10 mining sites and 1 residential camp (designated CA-SBR-769H, -10935H, -10936H, -10937H, -10938H, -10939H, -10940H, -10941H, -10942H, -10943H, -10944H). Mining activity occurred in the area for almost a century, with a peak period of operation between 1900 and 1920. All of the sites were considered be potentially eligible to the NRHP. Five of the 11 sites were found to be potentially eligible under Criterion B, for their association with J. Riley Bemby, a prominent individual in the 20th-century mining activities of the eastern Mojave Desert. Six sites were found to be potentially eligible under Criterion C, for their ability to demonstrate the process of mining with either simple or complex elements. Ten of the sites were found to be potentially eligible under Criterion D, based on the existence of trash scatters that may have the potential to yield important information about mining activities in the area. At some level, features at all of the properties retained sufficient integrity to demonstrate their significance. The mines and camp were determined to have the potential to address a variety of research topics, including questions about mine development and production as well as questions about the lives of miners and their families (Cowie, Baird, and MacWilliams 2005).

The WACC team returned to the Preserve in 2004 to record and evaluate the Rex Mine in the Providence Mountains. The Rex Mine, designated CA-SBR-11275H, was a small family-run mine that was in use from the early 1930s through to at least 1952. A total of 78 features and 14 artifact concentrations were recorded at the site. CA-SBR-11275H was found to retain a high degree of integrity and was considered to be eligible for the

NRHP under Criterion C for its ability to exhibit small-scale, short-term mining activity in the Mojave, such as the use of converted railroad cars for residences. CA-SBR-11275H was also found to be eligible under Criterion D for its potential to yield important information about the people who lived and worked there (Langan 2004).

Archaeological Investigations Northwest, Inc., recorded and evaluated the Clark Mountain properties of Ivanpah townsite and Ivanpah millsite in 2004. Both sites were considered to be potentially eligible to the NRHP as either contributing resources to a landscape or as a part of a district nomination that would include the entire Ivanpah mining complex. As contributing resources they were determined to be potentially eligible under Criterion A, for their association with early western silver-mining activities. They were also found to be potentially eligible under Criterion D, for their potential to yield important information about the mining processes used at the location and the people that worked and lived there (Chapman, Ozbun, and O'Brien 2004).

PROPERTY TYPES FOR MINING SITES IN THE MOJAVE NATIONAL PRESERVE

This section, adapted from Chapter 3 of *Mining Sites: Historic Context and Archaeological Research Design* prepared for the California Department of Transportation (HARD Mining Sites Team 2007), introduces types of archaeological resources associated with historic mining processes represented in the Mojave National Preserve. These property types do not exist in isolation, but must be identified and interpreted within their functional context. As used here, property types reflect the individual building blocks of mining sites, such as prospect areas, shafts, surface facilities, mills, and residential areas. Simple sites may be made up of only one or two types, while complex sites may have many, linked by function and time. These linked property types are what Donald Hardesty calls "feature systems" on mining sites in Nevada to distinguish "a group of archaeologically visible

features and objects that is the product of a specific human activity” (1988:9). This is a useful way to tie together different features into a functional process. In general, site significance increases with the size, visibility, and focus of these systems.

A similar, process-based approach to identifying property types is recommended in the National Park Service’s *Guidelines for Identifying, Evaluating, and Registering Historic Mining Properties* (Noble and Spude 1997). Other comparable approaches to recording and identifying features at mining sites have been developed by Hovis (1992) and Cunningham (1990), outlined in *Guidelines for Archeological Recording and Evaluation of Abandoned Mining Properties* prepared by the National Park Service’s Western Archeological and Conservation Center (Cowie et al. 2005).

Accurate interpretation of property types and feature systems—establishing function and time period—is critical. Determining that a pile of rocks is the result of hard-rock mining, or that it dates to the 19th century or Depression era, directly affects its significance values. In addition, for many of the sites that will not be preserved (whose limited data potential has been exhausted by its recording), this identification may constitute its last examination and documentation by archaeologists and historians. It is important that our final record of this mining activity be accurate. Interpretation is made more difficult when a mineral source is worked over several different time periods, with subsequent mining techniques and occupations erasing or overlying evidence of earlier processes. For sites representing several property types or feature systems, interpretation is greatly facilitated by physically reconstructing deduced mining processes on a map, and perhaps in a flow chart, to ensure an accounting of all the potential resources and their relationships. For complex sites, a mining engineer can contribute much to this exercise.

The links between processes or activities and the common types of archaeological mining resources are drawn below, grouped under six categories:

- Prospecting;
- Extraction;
- Ore processing;
- Intra-site ancillary facilities;
- Domestic remains pertaining to social, nontechnological elements of mining; and
- Regional linear sites that support the mining endeavor.

Mining involves locating and extracting various minerals from naturally occurring deposits. Prospecting is the act of searching for new mineral deposits and testing their value (Fay 1920:540). The two primary forms of deposits are lode and placer. Lode deposits are the original mineral occurrence within a fissure through country rock, also variously known as a vein or ledge. Hard-rock and quartz mining are two common terms referring to mineral extraction from lode deposits. Extracted lode minerals, especially those deep underground, generally require additional refinement, called beneficiation (discussed below in Ore-processing Property Types). Placer deposits are sedimentary formations containing minerals that have eroded from their parent lode into a variety of natural contexts, both shallow and deeply buried. The ubiquitous image of a 49er panning for gold along a gravel bar represents placer mining, although hydraulic, drift, and dredge mining also target this type of deposit. Placer minerals are generally “free” from parent material and do not require additional refinement once separated from worthless sediment. Placer miners followed “color” (gold) up drainages looking for the source, and often thereby discovered the parent outcroppings of lode ore. They also discovered eroding ancient riverbeds, now elevated above the modern landscape, which contained naturally deposited placer mineral deposits. Later, geological research played a larger role in locating minerals. Miners often used ingenuity to tailor their operations to local conditions for both lode and placer deposits. Prospecting and extraction technology differed for the two types of mineral deposits. Although there were placer claims

throughout the Preserve, the mineral industry was dominated by lode deposits and hard-rock mining techniques.

Lode refers to a mineral deposit located in fissures in country rock, and is nearly synonymous with the term *vein* as used by geologists. Lode deposits are tabular and clearly bounded, with orientations measured by their *dip* (angle from the horizontal) and *strike* (angle from the vertical). Although lodes may extend to the surface, they primarily lie underground and are accessed by excavated features such as shafts and adits, or by open-pit mines. Ore (mineral-bearing rock) extracted from the lode is usually processed first through crushing and then by physical or chemical separation devices. Lode sites produce waste rock (excavated rock that is not ore) and tailings (the discharge of unwanted processed material from mills and separators). Good discussions of lode technologies are found in Peele (1941), Hardesty (1988), Bailey (1996), Pearson (1996), Bunyak (1998), Limbaugh and Fuller (2004), Twitty (2005), and Young (1970).

Lode deposits, varying greatly, define the nature of the extraction and milling technologies applied to them. They are often grouped into geologic occurrences identified as zones, the most famous of which in California is the Mother Lode. Lode deposits can vary greatly in depth and width, with some surface quartz leads pinching out within a few hundred feet of the surface, while a few extend to a depth of more than 6,000 feet, with widths sometimes exceeding 50 feet.

Lode mining tends to be more complex than placer mining, requiring advanced technologies, skilled personnel, and substantial capital investment. Also, unlike placer deposits, extracted ore requires processing to free its minerals. Surface ore is naturally oxidized and its values can often be retrieved through simple crushing and physical separation. As veins extend deeper into the earth, however, minerals are typically chemically bound with sulfides and other mineral compounds. Miners developed various chemical processes to separate them (discussed below in Ore Processing Property

Types). Although extraction and processing technologies evolved over time, older techniques continued where newer ones were too expensive or inappropriate for the scale of the effort. What was the state-of-the-art in the industry was not necessarily what was practiced on the ground.

The range of hard-rock technologies is vast and complex and will not be detailed in this section; instead, the types of features commonly present on sites in the Preserve are described and some examples provided. Mining sites can contain multiple property types from multiple categories.

PROSPECTING PROPERTY TYPES

Prospect Pits and Surface Vein Workings

Surface vein workings are among the oldest evidence of hard-rock mining in California. During even the earliest years of the Gold Rush, placer miners were following gulches and encountering outcrops of quartz veins. Although “bull veins” (those without ore) were the most common, traces of minerals were evident in some outcroppings and prospectors learned to search these out. Float—mineralized rock broken out from eroding veins—indicates a nearby source, and gossans—surface mineralizations of iron-heavy deposits—signifies mineral veins underneath. Prospecting tools include picks, bars, and shovels and, in larger operations, wheelbarrows and ore cars to move ore and waste rock. Typically, an exposed vein is simply followed down into its outcropping, leaving an exposed rock stratum with its center gouged out like a cavity in a large tooth. The sides of these excavations are usually uneven, as digging simply ceased at the limits of the ore. The floors of these workings have generally filled in over the years with silt and natural debris, but larger examples often exhibit an “exit” on a downhill side for removal of rock, or a platform for a windlass or hoist in deep excavations. Waste rock will be conveniently disposed of near the workings. Included in the waste rock may be chunks of bull quartz, a good sign that the excavators were following a vein.

Claim Markers

The Mining Law of 1872 required that claim boundaries be distinctly and clearly marked to be identifiable on the ground. Historically, mining claim boundaries and discovery points were marked by stone cairns or wooden posts. Beginning in the 1960s PVC pipe was used. Stone cairns, and to a lesser degree wooden posts, sometimes contain a paper claim or assessment notice identifying a description of the claim type (placer or lode), a legal description of the location, and the name and address of the claimant. Tobacco cans, and later glass jars, often stored the claim document. Claim markers often represent the only remaining evidence of mining activity at a particular location. Swope and Vredenburg (2003) have suggested that patterns of claim markers in a district may offer value for interpreting the historical mining landscape.

EXTRACTION PROPERTY TYPES

Shafts and Adits and Facilities in their Vicinity

The entrance to underground workings is called a portal, and opens into either a shaft or an adit, providing access to the lode. Shafts sink down into the ground from the surface and can be vertical or on an incline, while adits are driven horizontally into hillsides (adits are often referred to as “tunnels”; among miners, however, the latter term is reserved for horizontal passages that have an entrance and an exit, as along roads and railroad grades). Shafts and adits vary according to the size of mining operation and the nature of the surrounding rock. Portals can be first identified by their associated waste-rock piles (see discussion below) as their openings may have caved in or been closed by dynamiting. Shaft-like openings that do not have



Figure 35: *Rock Cairn at the Garvanza Mine.*

any associated waste rock are likely air vents connected to deeper workings. When cut into a stable matrix, shafts are typically square, while adits may have a curved ceiling. Where the surrounding rock is unstable, shoring is used to reinforce the sides.

Shafts and adits require mechanisms for removal of underground waste rock and ore, and remains of these facilities are commonly present around the openings. Adits most frequently have ore cars running on tramways, or just a dirt path for wheelbarrows on smaller operations. Shafts require a hoisting device to raise the excavated material. While small shafts may operate with hand-run windlasses, larger operations require head frames with cables, buckets, and drum hoists. Footings for head frames straddle the shaft opening and remains typically consist of concrete bases topped with metal plates or bolts. Adjacent to these would be similar footings for the hoist drum. As mines deepened, devices such as Cornish pumps were installed to both ventilate and de-water the underground workings. Hoist power was provided by animals, steam, water, fossil fuel, and, later, electricity. Evidence for the power source might be found in

massive boiler footings or mounts for engines run by imported electricity or a generator.

The openings to deep shafts were usually collared with timbers and planks or concrete (after the 1880s) to stabilize the work area, although collapse of these openings after abandonment often makes them appear as large craters. In ranchlands, abandoned shafts are often surrounded with fencing to keep out livestock. **The bottoms of these large depressions are very unstable – often consisting of only a thin soil developed over fallen timbers and tree limbs – *and should never be entered.***

Underground Workings

Shafts and adits are built to access underground workings, a series of excavations providing access to the lode. Drifts (horizontal connectors) link various parts of the mine. While mining the ore body itself is frequently referred to as stoping. Underground miners sort the material they are sending to the surface into waste rock and ore so those at the top can handle each ore car lode efficiently. *Examination of underground workings is very dangerous.* The size, nature, and surrounding geology of a mine are vital to understanding its



Figure 36: Shaft at the Evening Star Mine.

Figure 37: Shaft and adit at the Garvanza Mine.



Figure 38: Collapsed shaft at the Allured Mine.

history. This information must be found in documentary records.

Open-pit Mines

Low-grade ores located near the surface could be mined through an open-pit system, much like a large quarry where rock is removed systematically in stepped benches. Excavation is generally by controlled blasting, with the ore separated and hauled to the mill and the waste disposed of nearby. In modern times both ore and rock are typically

loaded with large shovels and carried out by truck. Support facilities include a road system, machine shop or garage, and office. Some open pit mines used a leaching system to extract minerals, and such ponds may be located nearby. The Castle Mine just outside Preserve boundaries is one of the largest open-pit mines in the area. Smaller open-pit mines, such as the Golden Quail, have destroyed evidence of earlier historic operations.



Figure 39: *Two waste-rock piles at the Leiser Ray showing different country rock.*

Waste-rock Piles

Perhaps the most visible evidence of underground workings is waste rock. In following a vein, the vast majority of excavated rock is that surrounding the ore, and this waste rock is discarded immediately at the opening to the mine and allowed to accumulate in a downhill, gravity-formed mound or dump. Piles of waste rock not only indicate the location of uphill shafts and adits (which may be caved in and therefore not easily identifiable), but the size of the pile reflects the extent of the underground workings. Waste dumps are visible as unnatural contours on hillsides and for the lack of soil development and vegetation. For larger operations, waste-rock piles may be formed by sequentially dumping rock from ore cars, producing a long, flat-topped ridge that begins at the mine portal and is extended as the workings deepen. Mines that operated for a long time often incorporated waste-rock dumps into later development, terracing them for placement of

buildings or other facilities. As mineral-recovery techniques improved over time, old waste rock with low mineral values was processed to extract its values; an example is the Copper World Mine, where waste rock was reworked during World War II.

ORE PROCESSING (BENEFICIATION) PROPERTY TYPES

Once ore has been removed from a mine, valuable minerals must be separated from the gangue (undesired minerals). *Beneficiation* is a broadly applied term and can include crushing, stamping, screening, flotation, amalgamation, and smelting (Cowie et al. 2005:13–24). The technology of beneficiation developed diverse and sophisticated processes over the past centuries and only those most commonly found on sites in California are mentioned below. Milling sites often contain innovative and complex technologies that were added to and modified over time. Interpretation of



Figure 40: *A waste-rock pile formed by dumping from an ore cart at the Leiser Ray Mine. Remains of one of three mills at the site, additional waste-rock piles and stone retaining walls are in the background.*

these types of sites is dependent on thorough use of mining reports and documents and frequently requires the help of mining engineers.

Arrastras and Chilean Mills

An *arrastra* (or *arrastre*) is a shallow circular pit, rock-lined on its sides and flat bottom, in which broken ore is pulverized by drag stones. The drag stones are suspended from horizontal poles fastened to a central pillar and typically rotated by use of animal or human power, although later machine-powered examples can be found. The floor stones are usually of a hard material such as granite and exhibit a polished surface. The upper drag stones also have a polished, smooth undersurface and retain evidence of a bolt attachment imbedded on top. These simple grinding devices can be significant indicators of early mining activities, although they were also used into the 20th century on low-budget projects. Chilean mills are an adaptation of an arrastra and are generally constructed from iron. The Chilean mill has wheels that roll (rather than drag) around a central pivot to grind ore on top of the lower surface.

Introduced by Sonoran miners (*arrastrar* = to drag), they could be constructed with materials at hand and were quite effective in reducing ore to a

powder, from which minerals could be recovered by amalgamation or other simple separation processes. This type of milling is most productive for surface vein workings, where the ore has been naturally oxidized and does not require chemical processes for mineral recovery. Arrastras are rarely found intact as, upon abandonment, the floor stones are typically pulled up and the underlying soils panned to retrieve minerals that sifted between the cracks. Discussions of arrastras are found in Kelly and Kelly (1983) and in Van Bueren (2004).

Mills: Industrial Foundations, Pads, and Machine Mounts

Mills are not necessarily constructed adjacent to mine portals, although they may be. Mills require a power source and a steady supply of water, and it may be more expedient to locate the mill in the best place to access to those requirements and transport the ore. Mills may also be centrally located to serve a series of mines. Within the Preserve, essentially all springs had some sort of milling facility over time.

The first step in ore processing is crushing the rock into a powder that can be treated. The most common technology for accomplishing this was the stamp mill, where ore was fed into a cast-iron mortar box located under a battery of heavy vertical rods

(see also discussion of arrastras above). Through use of overhead cams, the rods were repeatedly raised about 6 inches and then allowed to fall, their heat-treated shoes falling on the mortar dies. The camshaft was rotated 80 to 100 times a minute by a belt-driven bull wheel, powered initially by water or steam (Limbaugh and Fuller 2004:65). Small, mobile, one- or two-stamp mills were effective on small sites, although batteries of five stamps were soon found to be the most effective. As operations expanded, stamp mills often grew in increments of two five-stamp batteries, resulting in some large mills of 100 and 120 stamps.

Archaeological evidence of mill sites increases with their size. Small, early mills were relatively ephemeral, leaving few traces. Unless the stamp mill itself was abandoned—leaving cast-iron shoes, cams, rods, and hopper-mortars in place—short-term operations may not be identified. Larger stamp mills can involve large excavations of earth and leave distinctive terraces, often with equipment mounts or foundations. They were nearly always built into hillsides, taking advantage of gravity feed to move ore through the stages of processing. At the

uppermost level, ore was delivered to the facility by tram or other vehicle, stored in bins and then fed into the hopper of a primary crusher where it was reduced to a uniform size. Jaw crushers were initially preferred, later largely replaced by ball mills, where ore was rotated with iron balls in large barrel-like devices (worn iron balls often mark these locations). Crushed ore was then fed into the stamps, where it was pulverized with the controlled use of water, creating pulp. The number of stamps is documented by footings for the batteries, grouped into 5 or 10 per footing. The width of the stamping floor often defines the width of the mill building itself.

Below the stamps, the lower level of the mill contains the amalgamation or concentrating tables. Here the discharged pulp, with the addition of small amounts of mercury (“quicksilver”), was processed to recover the minerals. This level has drains to carry off excess water from this wet processing area. Below the amalgamation level, pulp may be further processed in chlorination or cyanide tanks, or other innovative device, for final recovery. After 1870 various devices were introduced to improve this

Figure 41: *The remains of the mill at Vanderbilt.*





Figure 42: *One of three mills located at the Leiser Ray Mine.*

process and maximize recovery in the concentrates. The amalgam was then retorted to drive off (and then recapture) mercury with the resulting “sponge” shipped to a mint or smelter, or sometimes ingots were prepared on site. The final discards are dumped downhill as tailings.

Simple amalgamation worked well with free-milling gold, but not with refractory ores where gold was tightly bonded with other metallic minerals. In these, while gold was often clearly visible in ore samples, milling and the use of mercury did not permit its recovery. It took years of experimentation before solutions were found, and many tailings piles from early mills were later reworked to recover their minerals with improved processing. In the 1870s chlorination was the first breakthrough, but even this was expensive and relatively ineffective and was only productively used on large ventures. Cyanide was used with some success in the early 1900s, applied to reground slimes from ore initially treated with chlorination. Later flotation methods subjected the treated pulp to a frothing agent that separated the minerals in cell-like devices. Heap leaching of chunk ore was also sometimes successful in

recovering values from low-grade ores. No single recovery method worked in all mills, however, because of the different composition of local ores.

The final step was smelting through the application of heat. In the earliest years of mining in the Preserve, ore was shipped as far as Wales for smelting. Small smelters were located at Ivanpah and Valley Wells. Ore was also shipped to the Needles Reduction Company on the Colorado River.

At the mine, assaying was often conducted to determine the purity of the ore. The location of assaying can be recognized by chimney remnants, crucibles, and small amounts of slag often found around foundations that represent the assayer’s office near a mine site.

In the early years, mills were run by steam, produced in boilers or furnaces, and by water-powered impulse wheels, modeled on those made by Pelton. Remains of boilers may be evident adjacent to mill sites and are distinguished by rectangular platforms of brick or other refractory insulating material which encompassed large, iron horizontal-boilers.

In the 1890s electrical power plants began to be built, sometimes by independent entities and sometimes by the mining interests themselves. Engine mounts in mills are characterized by raised concrete footings topped by heavy bolts. Evidence of electrical power may also be evident in wire conduits, switch boxes, and insulators. In later years local generators may also have been used.

Mill Tailings

The undesired portion of the ore discharged from mills is identified as tailings. These were generally in the form of slurry, and for most of the 19th century were allowed to run down adjacent creeks and gullies. A federal anti-debris law, the Caminetti Act of 1893, prohibited miners from dumping their waste into rivers and streams. While aimed primarily at hydraulic-mining debris, this act also addressed lode-mining tailings. As a result, mill operators began constructing impound areas. These tailings ponds were typically formed by constructing a dam across a downstream ravine and allowing the tailings to build up behind it. Heavier portions of the tailings settled into flat, meadow-like formations while the water portion ran over a spillway. Abandoned with their mills, the dams for these holding ponds were typically breached in later years, allowing the stream to cut through the accumulated tailings and reach its bed once again. These breached ponds can be identified by the cliff-like sides of the stream, which expose mineral-colored fines unlike the surrounding soils, and by the remnants of the flat pond surface preserved along the sides of the drainage.

Mill tailings contain high levels of minerals and are often distinguished not only by their coloration but also by an absence of vegetation. Many modern reclamation efforts are designed to contain old tailings and prevent water from leaching their often toxic contents into waterways.

ANCILLARY MINING PROPERTY TYPES

These are other site-specific facilities and systems that are commonly found in association with extraction and beneficiation activities. They

represent important internal components assisting mining and milling operations.

Structural Remains

Mining sites may contain a myriad of buildings related to their mining and milling operations. Although some are identifiable by distinctive artifacts, construction techniques, or locations, identification of most is achieved through comparing documentary records (mine inventories, photographs, and maps) with remains on the ground. Long-operating mines periodically upgraded or revamped their operations, and over time buildings were moved, demolished, or changed in function. The buildings and structures in evidence on a site may not have been in use at the same time.

Building remains may be from offices, sheds, storage buildings, stables, and shops, the locations of which may be indicated by concrete or stone foundations or simply by leveled pads and retaining walls. Wooden structures were often covered with metal sheeting and may be evidenced by lumber, cut or wire nails, building hardware, or fragments of window glass. Assay offices may be distinguished by the remains of furnaces or retorting facilities, as well as fragments of crucibles and cupels.

Change rooms, where company gear and workers' personal equipment could be stored, are located next to mine portals or mills. These facilities were installed not only for the convenience of the workers, but to prevent high-grading (theft) of ore by employees.

Powder houses stored the mine's explosives and were usually located some distance from other structures. These were usually small windowless rooms, often semi-subterranean (commonly built into a hillside) and featured thick walls of stone, brick, or concrete.

Blacksmith shops maintained a mine's equipment and vehicles. Their former locations may contain various pieces of worked metal, raw materials, coal or coke, and slag from forging; the remains of the forge may also be evident. One of a mine blacksmith's principal duties was sharpening



Figure 43: *This concrete foundation at the Leiser Ray Mine was the assayer's office. The area was littered with fragments of crucibles.*

Figure 44: *The powder house at the Evening Star Mine was located some distance from the main workings and was heavily constructed.*



miners' drills. Nineteenth-century mines had stables and corrals for livestock used to haul ore cars and wagons. Stone foundations and wood posts with wire fence lines may be evident. More recent mines require a garage and shop which may feature tanks for oil and gasoline, grease pits, and vehicle parts.

Structural remains with domestic artifacts (ceramics, bottles, and cans) are discussed below in Mining Community Property Types.

Site-Specific Transportation Features

Within a mining site, transportation systems were needed to move ore, waste rock, and people. On the simplest sites, hauling was done by the miners themselves or by pack animals on single-track trails. Even modest development, however, had to address how to remove waste rock from lode mines and deposit it out of the way. For adit portals, tramways for ore cars commonly ran out the entrance along a level to the adjacent waste rock dump, both being extended as the mine deepened. Tramways were also used to haul ore to mills for processing, either run along prepared grades or on trestles. The ore cars could be powered by animals, gravity, fossil fuels, or electricity. Overhead tramways with buckets suspended on cables were also used to connect mines in inaccessible locations to mills or transportation facilities.

Roads were always present to connect mine facilities, and these grew in importance when trucks replaced tramways for hauling both ore and waste rock.

Site-specific Water-conveyance Systems

Water played an important role in processing lode ore. In the desert, water was always an obstacle, often having to be hauled in from great distance. Water was required for all types of milling, and conveyance and storage systems will be present on sites. Reservoirs, cisterns, and water tanks may be found above mills to allow for gravity feed, while distribution may have been done in pipes. Remains of old riveted penstock systems may be present. Drains and methods to direct run-off from the mills will also be in evidence.



Figure 45: *The Tramway Mine had an impressive structure used to transport ore downhill from the main shaft.*

Water-conveyance systems bringing water to a mill from sources some distance away (outside of the site boundaries) are recorded separately as individual sites. They may have tapped resources many miles away and served several mines or communities in the vicinity. Water-conveyance systems for mines are also described in detail, with recording methods and registration requirements, in the JRP/Caltrans *Water Conveyance Systems in California* (JRP and Caltrans 2000).

MINING COMMUNITY PROPERTY TYPES

Miners often lived at the mines, and this property type addresses facilities related to the domestic residential activities of the miners, support staff, and their families. Although often marked by impermanence, mining-camp residents created a distinct community (Douglass 1998:106) that is integral to the study of the mining site. To be



Figure 46: *A mule trail near the workings at the top of the Bullion Mine.*



Figure 47: *At the Von Trigger Mine, water was channeled in this concrete flume.*

considered elements of a mining feature system, the domestic property types discussed below must be physically and historically associated with prospecting, extraction, or milling activities. Resources related to mining-site residences, if present, are generally found integrated within or adjacent to mineral operations. There may be numerous remains of structures on mining sites, especially more developed ones, that generally fit

the architectural remains described below (see Property Type Structural Remains under Ancillary Mining Property Types). The residential property types addressed here, however, are distinguished by one or more of the following:

- 1) presence of domestic artifacts;
- 2) distinctive domestic features, such as hearths or baking ovens; or
- 3) identification as residence-related in documents.

In many respects the mining community reflects a work camp composed for mining. Communities brought together primarily for the mineral industry may grow into townsites. Some townsites formed around mine sites more spontaneously, such as Ivanpah and Vanderbilt, while others such as Providence were company towns created by a specific mining venture.

Domestic Structural Remains

The simplest temporary dwelling form is the tent, or lean-to with a canvas cover. An improvement was a half-walled version, where the lower sides of a one-room dwelling was made of stone, logs, or lumber and the sides of the canvas roof could be rolled down to close the walls. Located on natural earthen flats or leveled pads, these simple dwellings required little in the way of site improvements and could be easily moved to the next opportunity. A tent flat can be barely noticeable if located on a naturally level area but may be distinguished by a small retaining wall (as minimal as one row of stones) on the downhill side. Sparse sheet refuse is usually found on the flat itself or extending downhill away from the shelter. The presence of a few large stones may indicate a U-shaped hearth or fire ring. These hearths may consist of flat stones set on end to form a firebreak, or a few courses of stacked local rock.

A dugout describes an open, often rock-lined cavity in a hillside, usually the size of a single room.

In the mining community these generally served the same functions as described above for foundations: they were used as dwellings as well as for other functions such as storage. Most simply they could appear as a single, slumped-in cut into the hillside. Better developed examples were fully excavated and may have been lined with stone, poured concrete, or milled lumber framing, and supported metal or wood roofing. Wood construction elements, if not entirely decayed, will likely be collapsed within. Dugouts are typically at least partially filled-in, often burying structural elements and living surfaces. For large dugouts, the removed fill should be visible around the structure.

More substantial dwellings employed stone foundations to raise wooden walls and floors above ground level; these can include stone piers to support posts or floor joists as well as complete stone perimeter foundations. Flat stones used as post footings on a flat can be barely noticeable, such as those used for simple cabins. Post-and-pier construction was used into the early-20th century



Figure 48: Steps leading to the domestic foundation at the Tramway Mine. The structure burned as evidenced by charred wooden posts.



Figure 49: *A stone cabin at the Garvanza Mine took advantage of the natural geologic formations.*

for frame dwellings, as well as for bunk-houses and dining halls found on some mining sites. Domestic structures with stone masonry walls, or of adobe or rammed-earth, may also be present. A full or partial cellar, typically reinforced with stone masonry, may have been incorporated. Roofs were commonly of metal or wood. Supervisors or managers may have resided on-site in large or unique structures, possibly higher in elevation or away from common laborers' housing.

Later, poured concrete slabs and perimeter foundations were used for housing. Concrete constructions are common on well-developed mining sites after 1900. Board-formed, poured foundations date to after World War I, although smaller sites may have continued using simple stone technologies. Sites dating to the 20th century show increasing evidence over time of utilities for electric lighting, telephone, and domestic water supply.

On more developed mines, evidence of large foundations (exceeding 30 ft. in length) in association with personal domestic debris may represent bunkhouses or other collective housing.

Community dining halls and kitchens will be distinguished by large refuse piles containing tablewares; large cans, bottle, and jars; and faunal remains.

Domestic Artifact Deposits

Domestic sheet refuse describes a horizontal scattering of discarded items typically found around a dwelling, and is one of the most common types of domestic artifact deposits on rural mining sites. Artifact accumulation results from unintended loss as well as intentional waste disposal such as casting debris away from a dwelling. Sheet refuse may be found throughout the living area of a dwelling, or as deposit located adjacent to and downhill from the residence area. Disposal of debris into natural features such as gullies may create vertical interfaces similar to the "hollow filled features" discussed below.

In both situations, sheet refuse may retain a form of horizontal stratigraphy that represents unique activities or episodes; one occupant may have discarded debris one direction, while another may have tossed debris in another, thereby creating



Figure 50: *Domestic sheet refuse at the Francis Mine.*

distinguishable deposits. Don Hardesty (1987:85) noted this quality on mining sites, recognizing that site components may be organized horizontally instead of vertically. The implications of this for research and integrity have been recognized as an important element of evaluations (Cowie et al. 2005:62).

Developed mines with sedentary communities that resemble a town more than a camp may exhibit more intentional methods of refuse disposal. Artifact deposits are found buried or partially eroding from features such as trash pits or prospect pits, or from privies, wells, dugouts, cellars, or ditches abandoned at the time of disposal. It should be noted that artifacts found in abandoned features, such as basement depressions, likely reflect activities after the facility was abandoned, not the period of use. These hollow-filled features offer a rich assemblage of artifacts potentially with traditional vertical stratigraphy. Many of these types of features are buried, however, and must be found through remote sensing, excavation, or use of documents.

Domestic Landscape Features

Members of the mining community may have made a number of minor improvements to the landscape. Residents may have planted a garden or orchard, or created areas to pass the time or socialize. These activities survive in the form of stone garden terraces or retaining walls, surviving plantings, bedding borders, or walkways. A stand of bamboo at the Garvanza Mine, for example, indicates an attempt by miners to alter the natural surroundings.

INTER-SITE LINEAR TRANSPORTATION PROPERTY TYPE

These are separate, distinct sites that may extend many miles, creating a link between the mining site and the outside world. They represent linear systems for delivery of services or access and are recorded as individual and distinct entities. The nexus of these common property types with a particular mine, however, should be considered a feature or features of that mining site.

Early access to mines was by way of single-track trail, such as the network of mule trails that quickly developed to service mining camps. Such trails are narrow and often have stone masonry retaining walls; their width is most accurately measured at switchbacks and outcrops. Segments of trails are often completely erased by later activities. Wagon roads replaced portions of these systems as some areas grew into viable settlements. These typically have stone masonry, and often a berm on the downhill side from grading. Over time, additional road improvements, such as paving, became standard practice. Earthen and paved roads form a network across the rural landscape. Mining operations patched into existing transportation networks, or financed their own service connections. Large, capitalized operations, in particular, typically improved road systems linking to the larger transportation network. Railroads were also an integral part of intra-site transportation. The several railroads that crisscrossed and skirted the Preserve boundaries provided opportunity for an isolated locale.

CONTINUED RESEARCH

Mining sites are often complex, and the sheer size of the Preserve and vast number of mining sites within it makes it important to carefully choose which sites receive research attention. Shumway, Vredenburg, and Hartill (1980) have identified mining-related sites from throughout the California desert area that warrant continued research and evaluation. This list assesses historic mining locations according to their research potential (a site's ability to yield data for interpreting the history of mining) and their public and legal significance (Table 4). Public significance relates to a site's potential value for education and interpretation, while legal significance considers whether a site is potentially eligible for the NRHP. Recommendations are also provided that emphasize specific public outreach and interpretive programs. Due to the scope of their project, only six mining sites from within the Preserve were addressed.

Ted Weasma has developed a list of mining sites determined to be important to the history of



Figure 51: *The road leads from the Ivanpah Valley to the Bullion Mine. It was the only route to haul goods and materials in and ore out.*

mining in the Preserve (Table 5; Figure 52). The sites have been selected because they have identified historical information, have yielded copious or uncommon mineral types, have abundant or unusual extant structures and features present, and/or are important to the development and settlement of the Eastern Mojave. The list includes mining properties that have previously been evaluated, are currently located on private property, and/or may not retain the integrity necessary for inclusion in the NRHP. Appendix B provides more detailed information about each location. The sites have been assessed for their possible research potential, if known, and have been assigned a period or periods of significance relating to the historic context statements outlined in this report. The periods of significance are based on information from mining journals, especially Wright et al. (1953). Due to the enormity and complexity of mining sites in the Preserve, this list can help provide a guideline for future research.

Appendix C is provided on a CD-ROM attached to the back page of this report. The CD contains (1) a personal geodatabase file named MOJA Mining Resources, and (2) a geodatabase file named Topographic Map. Contained within MOJA Mining Resources are geospatial data consisting of a boundary file of the Preserve, point locations for 461 mining and mining-related sites located within the Preserve (provided by David Moore, GIS Specialist), and a related table detailing features at sites visited and documented by Weasma and Gordon Pine (lands coordinator/geologist). The Topographic Map geodatabase file contains a mosaic image of the corresponding USGS 7.5-minute topographic quadrangles and index covering the Preserve area. The geodatabase is enhanced from a table adapted from data compiled by Weasma (2005b, 2007). The database provides mine name, identification numbers, and location, as well as, if known, claimant information, mineral sought, years of operations, and district affiliation. Any available claimant information is provided in a separate database also adapted from Weasma (2005a).

Table 4. Site Significant Assessment for Mojave National Preserve

adapted from Shumway, Vredenburg and Hartill (1980)

Site Name	Research Potential (high, medium to high, medium, low to medium, low)	Public Significance (1 - low to 5 - high)	Legal Significance (1/local, 2 - 3/regional, 3 - 4/statewide, 4 - 5/national)
Bonanza King	Medium	3.5	4
Ivanpah	High	4.2	3.5
Macedonia	High	4.2	4
New York Mine	High	2.8	4
Vanderbilt	High	2.6	3
Copper World	High	4	3.5

**Table 5. Potentially Important Mine Locations in
Mojave National Preserve**

Silver Mining 1863–1893		Mining during the Great Depression	
Bonanza King	Taylor	Vanderbilt	Telegraph
Sagamore	Columbia**	Von Trigger	Allured
Bullion	Ivanpah**	Oro Fino	Columbia**
Stonewall		Brannigan	Colosseum**
		Paymaster	Rex**
		New Trail	Standard**
Golden Years of Mining 1894–1929		Mining during World War II and Beyond	
Sagamore	Big Hunch	Vulcan	Eveningstar**
Copper World	Boomerang	Aiken Cinder	Silverado**
Vanderbilt	Giant Ledge	Pacific Flourite	Colosseum**
Death Valley	Gold Bronze		
Von Trigger	Golden Quail		
Bullion	Hidden Hill		
Paymaster	Leiser Ray		
Garvanza	Mojave Tungsten		
Vulture	Francis		
Mammoth	Tramway		
New Trail	Columbia**		
Big Horn	New Era**		**Mines previously evaluated
	Standard**		

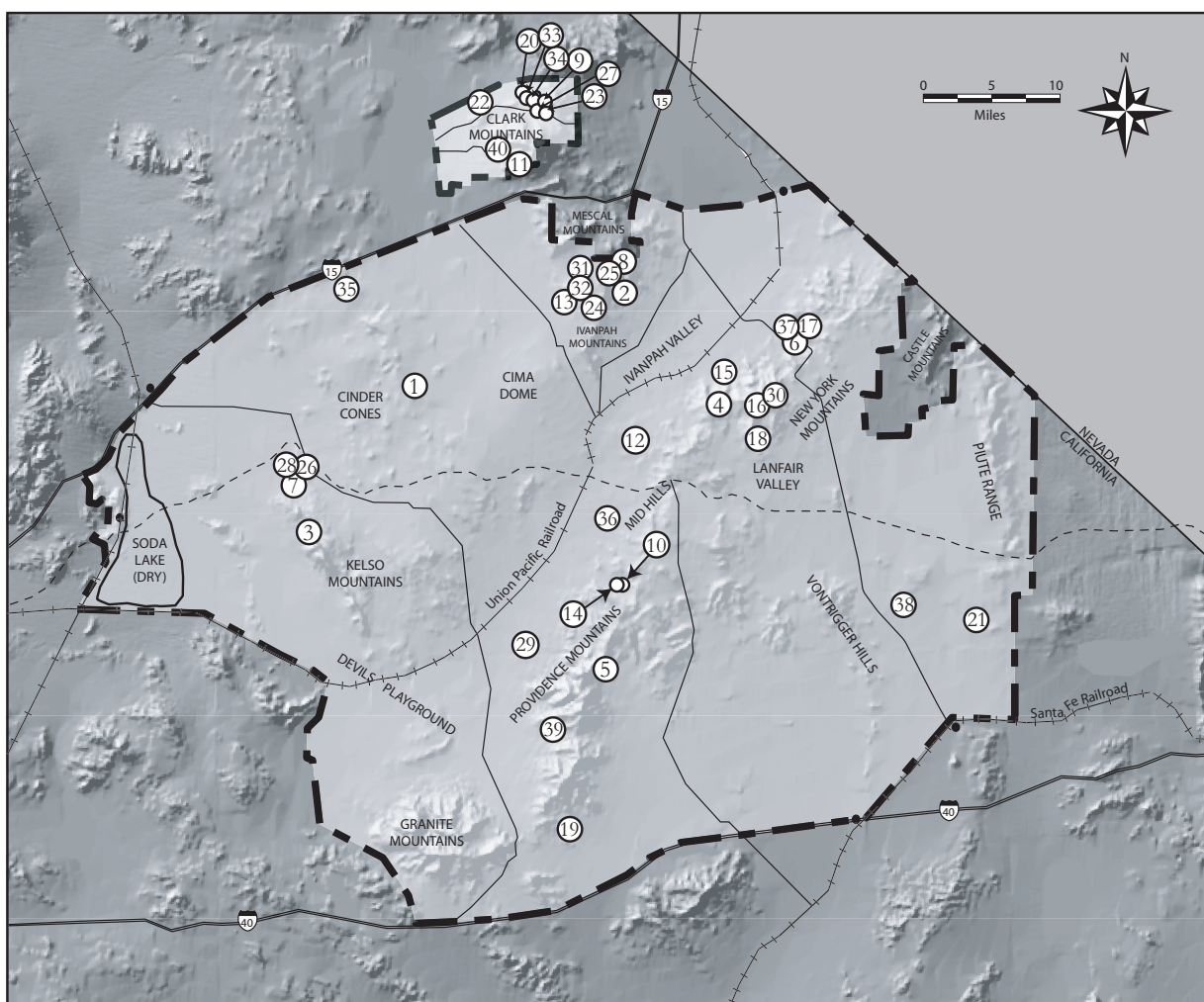


Figure 52. Important mining locations in the Preserve.

- | | | | |
|-----------------|------------------|----------------------|--------------------|
| 1. Aiken Cinder | 11. Copper World | 21. Leiser Ray | 31. Silverado |
| 2. Allured | 12. Death Valley | 22. Mammoth | 32. Standard 1 & 2 |
| 3. Big Horn | 13. Eveningstar | 23. Mojave Tung. | 33. Stonewall |
| 4. Big Hunch | 14. Francis | 24. New Era | 34. Taylor |
| 5. Bonanza King | 15. Garvanza | 25. New Trail | 35. Telegraph |
| 6. Boomerang | 16. Giant Ledge | 26. Oro Fino | 36. Tramway |
| 7. Brannigan | 17. Gold Bronze | 27. Pacific Fluorite | 37. Vanderbilt |
| 8. Bullion | 18. Golden Quail | 28. Paymaster | 38. Von Trigger |
| 9. Colloseum | 19. Hidden Hill | 29. Rex | 39. Vulcan |
| 10. Columbia | 20. Ivanpah | 30. Sagamore | 40. Vulture |

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Appendix A

State Trinomial and Primary Numbers for Mining Sites in Mojave National Preserve

APPENDIX A

State Trinomial and Primary Numbers for Mining Sites in Mojave National Preserve

USGS Topographic Quadrangle	State Designation
CLARK MOUNTAIN	CA-SBR-2377/H CA-SBR-2978H CA-SBR-2980H CA-SBR-3189H CA-SBR-4876H CA-SBR-4877H CA-SBR-4889/H CA-SBR-4890H CA-SBR-5302/H CA-SBR-6562H CA-SBR-6957H CA-SBR-10626H P36-063221-224
IVANPAH LAKE	CA-SBR-9752/H
VALLEY WELLS	CA-SBR-4888/H
SOLOMON'S KNOB	CA-SBR-205/H CA-SBR-3729/H CA-SBR-9747H
MESCAL RANGE	CA-SBR-768H CA-SBR-769H CA-SBR-770H CA-SBR-771H CA-SBR-7357H CA-SBR-7393H CA-SBR-7811H CA-SBR-7813H P36-062832
MINERAL HILL	CA-SBR-7801H CA-SBR-9740H CA-SBR-10805H
NIPTON	Ø
CRESENT PEAK	Ø
GRANITE SPRINGS	CA-SBR-4554H

USGS Topographic Quadrangle	State Designation
HALLORAN SPRINGS	CA-SBR-2981H
COW COVE	Ø
CIMA DOME	CA-SBR-778H CA-SBR-10935H CA-SBR-10936H CA-SBR-10937H CA-SBR-10938H CA-SBR-10939H CA-SBR-10940H CA-SBR-10941H CA-SBR-10942H CA-SBR-10943H CA-SBR-20033H CA-SBR-20034H CA-SBR-20035H
JOSHUA	Ø
IVANPAH	CA-SBR-779H CA-SBR-3049H CA-SBR-3062H CA-SBR-3063H CA-SBR-10593H CA-SBR-10594H
CASTLE PEAKS	Ø
HART PEAK	CA-SBR-2642/H CA-SBR-3060H CA-SBR-5710H CA-SBR-5837H CA-SBR-5877H CA-SBR-5946H CA-SBR-5962H CA-SBR-5971H CA-SBR-6055/H CA-SBR-7318H
SEVENTEEN MILE	Ø
SODA LAKE NORTH	CA-SBR-7158H
INDIAN SPRING	CA-SBR-1856H
MARL MOUNTAIN	CA-SBR-10267/H
CIMA	Ø
MID HILLS	Ø
PINTO VALLEY	Ø

USGS Topographic Quadrangle	State Designation
GROTTO HILLS	Ø
EAST OF GROTTO	Ø
SODA LAKE SOUTH	Ø
COW HOLE MT.	Ø
OLD DAD MT.	Ø
KELSO	Ø
HAYDEN	Ø
HACKBERRY MT.	CA-SBR-1680/H CA-SBR-2806H CA-SBR-4062H CA-SBR-6047/H CA-SBR-6258H CA-SBR-6259H CA-SBR-6260/H
WOODS MT.	Ø
COLUMBIA MT.	CA-SBR-3045H
SIGNAL HILL	Ø
GOFFS	Ø
FENNER HILLS	Ø
HOMER MT.	Ø
WEST OF JUNIPER	Ø
DESERT SPRING	Ø
COLTON WELL	CA-SBR-3061H
KELSO DUNES	Ø
FOUNTAIN PEAK	CA-SBR-328H CA-SBR-548H CA-SBR-3065H CA-SBR-6307H CA-SBR-11275H
GLASCOW	Ø
BUDWEISER WASH	CA-SBR-9520/H CA-SBR-9522/H

USGS Topographic Quadrangle	State Designation
BIGHORN BASIN	CA-SBR-1764H CA-SBR-3792H CA-SBR-9533H
W OF BLIND HILLS	Ø
BLIND HILLS	Ø
VAN WINKLE SPRING	Ø
FENNER	Ø
BROWN BUTTES	Ø

Appendix B

Important Mine Site Data

IMPORTANT MINE SITE DATA

Aiken Cinder Mine

AML PSI Number	376
State Trinomial	N/A
Geographic Location	USGS topographic quadrangle Marl Mountains, Calif. T13N/R12E UTM, Zone 11: Nad 83 615996 mE/3899294 mN
Previous Documentation	Bureau of Mines 1985
Mineral	Cinders
History	1954–1983
Recorded Features	Recorded by Weasma; on file MNP
District	Unknown
Period of Significance	Mining in the MNP during World War II and Beyond

Allured Mine

AML PSI Number	177
State Trinomial	N/A
Geographic Location	USGS topographic quadrangle Joshua, Calif. T15N/R14E Section 22 UTM, Zone 11: Nad 83 638280 mE/3915322 mN
Previous Documentation	Tucker and Sampson 1931:265; Tucker and Sampson 1943:430; Wright et. al 1953:61
Mineral	Copper, gold, silver
History	1918; 1925–1940; 1947; 1949; workings include nine claims in three groups—Hillside, Oxide, and Cuprite
Recorded Features	Foundation Powder Room 3 Adits
District	Mescal
Period of Significance	Great Depression Mining in MNP

IMPORTANT MINE SITE DATA

Big Horn/Mabel Group

AML PSI Number	370
State Trinomial	N/A
Geographic Location	USGS topographic quadrangle Van Winkle Spring, Calif. T12N/R10E Section 13 UTM, Zone 11: Nad 83 633412 mE/3856485 mN
Previous Documentation	Cloudman, Huguenin, and Merrill 1919:801; Tucker and Sampson 1931:303–304; Tucker and Sampson 1943:441–442; Wright et al. 1953
Mineral	Gold
History	1918–1937; workings include 18 claims— Mabel, Contention, Subway, Big Horn
Recorded Features	Cabin 3 Concrete Slabs 5 Rock Walls Windlass Rock Alignment Outhouse Tent Platform 2 Adits 2 Declines 4 Propects 4 Posts
District	Unknown
Period of Significance	Golden Years of Mining in MNP

Bonanza King/Providence

AML PSI Number	565
State Trinomial	CA-SBR-548H; (Providence - CA-SBR-321H)
Geographic Location	USGS topographic quadrangle Fountain Peak, Calif. T10N/R14E Section 3 UTM, Zone 11: Nad 83 636331 mE/3871997 mN
Previous Documentation	Cloudman, Huguenin, and Merrill 1919:827; Crawford 1894:376; Crawford 1896:330,606; De Groot 1890:532; Tucker and Sampson 1931:342; Tucker and Sampson 1943:475; Wright et al. 1953:No.236
Mineral	Gold, silver, copper, lead, zinc
History	1880–1893; 1901–1927 (intermittent); 1960s
Recorded Features	Providence recorded by Nichols 2005; on file MNP
District	Trojan
Period of Significance	Silver Mining in MNP

IMPORTANT MINE SITE DATA

Big Hunch

AML PSI Number	290
State Trinomial	N/A
Geographic Location	USGS topographic quadrangle Ivanpah, Calif. T14N/R15E Section 35 UTM, Zone 11: Nad 83 650280 mE/3902633 mN
Previous Documentation	Tucker and Sampson 1943:497; Wright et. al. 1953:No.290
Mineral	Molybdenum
History	1917–1918; 4 claims— Omega, Beta, Big Hunch, and Big Hunch No. 1
Recorded Features	2 Adits 2 Declines 2 Trenches 3 Prospects 12 Road Segments Post
District	Unknown
Period of Significance	Golden Years of Mining in MNP

Boomerang Mine and Mill

AML PSI Number	264
State Trinomial	CA-SBR-3049H
Geographic Location	USGS topographic quadrangle Ivanpah, Calif. T14N/R16E Section 3 UTM, Zone 11: Nad 83 658931 mE/3910059mN
Previous Documentation	Cloudman, Huguenin, and Merrill 1919:816; Crawford 1894:230; Crawford 1896:320; Tucker and Sampson 1931:317; Tucker and Sampson 1943:464; Wright et al. 1953:No.196
Mineral	Gold, silver, copper, lead, zinc
History	Operations began in 1891; 17 claims
Recorded Features	Not recorded
District	Vanderbilt
Period of Significance	Golden Years of Mining in MNP

IMPORTANT MINE SITE DATA

Brannigan Mine

AML PSI Number	365
State Trinomial	N/A
Geographic Location	USGS topographic quadrangle Seventeen Mile Point, Calif. T13N/R10E Section 26 UTM, Zone 11: Nad 83 601222 mE/3893414mN
Previous Documentation	Wright et al. 1953:72-73
Mineral	Gold, silver, ornamental stone
History	1928-1935; 1938-1940
Recorded Features	Railroad 34 Rock Walls 6 Trail Segments 2 Can Dump Ore Chute Windlass Platform Forge Chimney 21 Adits 3 Cuts 7 Declines 6 Shafts 22 Trenches 19 Prospects 3 Discovery Monuments 27 Posts 3 Road Segments
District	Solo
Period of Significance	Great Depression Mining in MNP

IMPORTANT MINE SITE DATA

Bullion Mine

AML PSI Number	164
State Trinomial	N/A
Geographic Location	USGS topographic quadrangle Mineral Hill, Calif. T15N/R14E Section 9 UTM, Zone 11: Nad 83 637670 mE/3918085mN
Previous Documentation	Tucker and Sampson 1943:475
Mineral	Silver, copper, lead
History	1860s–1870s; 1916–1917; 1960s
Recorded Features	2 Adits 4 Declines 2 Propsects 2 Shafts Trench Post 2 Cabins Can Dump Road
District	Bullion
Period of Significance	Silver Mining in MNP; Golden Years of Mining in MNP

Colosseum Mine (California Group)

AML PSI Number	37
State Trinomial	CA-SBR-4876H; (Gowman's Mill – CA-SBR-4877H)
Geographic Location	USGS topographic quadrangle Clark Mountain, Calif. T17N/R13E Section 10 UTM, Zone 11: Nad 83 629885 mE/3937199 mN
Previous Documentation	Reynolds 1982; Tucker and Sampson 1931:291–292; Tucker and Sampson 1943:446; Wright et al. 1953:No.82
Mineral	Gold, silver, copper, lead
History	Unprofitable workings in 1880s; 1929–1932; 1935–1942; 34 claims
Recorded Features	Discussed in Reynolds 1982
District	Clark
Period of Significance	Great Depression Mining in MNP

IMPORTANT MINE SITE DATA

Columbia Mine (Macedonia, Castor Pollux)

AML PSI Number	457
State Trinomial	??
Geographic Location	USGS topographic quadrangle Columbia Mountain, Calif. T11N/R14E Section 3 UTM, Zone 11: Nad 83 638851mE/3881372mN
Previous Documentation	Tucker and Sampson 1931:275; WACC 2000: on file MNP; Wright et al. 1953:No.244
Mineral	Gold, silver, copper, lead
History	1863; 1871–1872; 1883–1887; 1897–1905; 1910; 1926–1938
Recorded Features	Discussed in WACC 2000
District	Macedonia/Kelso
Period of Significance	Silver Mining in MNP; Golden Years in MNP; Great Depression Mining in MNP

Copper World

AML PSI Number	85
State Trinomial	(Valley Wells – CA-SBR-4888H)
Geographic Location	USGS topographic quadrangle Clark Mountain, Calif. T16N/R13E Section 5 UTM, Zone 11: Nad 83 626631 mE/3929982 mN
Previous Documentation	Cloudman, Huguenin, and Merrill 1919:786; Crawford 1894:69; Crawford 1896:61; Tucker and Sampson 1931:269; Tucker and Sampson 1943:432–433; Wright et al. 1953:63
Mineral	Copper, lead, silver
History	1869; 1898–1919; 1942
Recorded Features	2 Agave Roasting Pits Rock Wall 5 Adits Decline 2 Trenches Prospect 2 Posts
District	Clark
Period of Significance	Golden Years of Mining in MNP

IMPORTANT MINE SITE DATA

Death Valley Mine

AML PSI Number	408
State Trinomial	N/A
Geographic Location	USGS topographic quadrangle Mid Hills, Calif. T13N/R14E Section 11 UTM, Zone 11: Nad 83 640206 mE/3898588 mN
Previous Documentation	Tucker and Sampson 1931:348–349; Tucker and Sampson 1943:480; Wright et al. 1953:106–107
Mineral	Silver, gold, lead
History	1906–1921; 1951–; two main shafts— Death Valley and Arcalvada
Recorded Features	<ul style="list-style-type: none"> Adit 4 Declines Leach Vat 10 Roads 7 Shafts Stope 4 Rock Walls Corral Headframe Hoist House House Cabin 2 Wood Foundations Tripod Conveyor Footing Concrete Foundation 2 Chicken Coops Workshop/Garage Outhouse Root Cellar 2 Can Dumps Water Trough Mill Building 2 Cinder Block Tanks 2 Open Pits Tailings 18 Trenches 20 Prospects 10 Discovery Monuments 42 Posts
District	Cima
Period of Significance	Golden Years of Mining in MNP

IMPORTANT MINE SITE DATA

Evening Star (Bernice, Maynard, Rex, Cima)

AML PSI Number	193
State Trinomial	CA-SBR-10936H
Geographic Location	USGS topographic quadrangle Cima Dome, Calif. T15N/R13E Section 25 UTM, Zone 11: Nad 83 632376 mE/3914031 mN
Previous Documentation	Cowie, Baird, and McWilliams 2005; Tucker and Sampson 1943:498–499; Wright et al. 1953:147–148
Mineral	Tungsten, tin
History	1900–1910 (unproductive copper mining); 1939–1940 (tungsten); 1942–1944 (tin)
Recorded Features	56 features; discussed in Cowie, Baird, and MacWilliams 2005
District	Standard
Period of Significance	Mining in MNP during WWII and Beyond

Francis Mine

AML PSI Number	459
State Trinomial	N/A
Geographic Location	USGS topographic quadrangle Columbia Mountain, Calif. T11N/R14E Section 4 UTM, Zone 11: Nad 83 638271mE/3881393mN
Previous Documentation	Tucker and Sampson 1931:271–272; Tucker and Sampson 1943:434; Wright et al. 1953:No.23
Mineral	Copper, silver
History	1910s
Recorded Features	Foundation Post 2 Adits 3 Shafts
District	Kelso
Period of Significance	Golden Years of Mining in MNP

IMPORTANT MINE SITE DATA

Garvanza Mine (Carbonate Group)

AML PSI Number	287
State Trinomial	N/A
Geographic Location	USGS topographic quadrangle Ivanpah, Calif. T14N/R15E Section 23 UTM, Zone 11: Nad 83 650516 mE/3905133 mN
Previous Documentation	Cloudman, Huguenin, and Merrill 1919:841; Tucker and Sampson 1931:367; Wright et al. 1953:No.360
Mineral	Silver, copper, gold, lead, tungsten (molybdenum, thorium—never produced)
History	1907–1919 (intermittent)
Recorded Features	Well Foundation Cairn Millsite Flume Shaft 2 Adits 3 Cabins
District	Unknown
Period of Significance	Golden Years of Mining in MNP

Giant Ledge

AML PSI Number	296
State Trinomial	N/A
Geographic Location	USGS topographic quadrangle Ivanpah, Calif. T14N/R16E Section 31 UTM, Zone 11: Nad 83 654754 mE/3902647 mN
Previous Documentation	Aubury 1908:333; Cloudman, Huguenin, and Merrill 1919:786; Tucker and Sampson 1931:272; Tucker and Sampson 1943:434; Wright et al. 1953:No.24
Mineral	Copper
History	1908–1913; 4 claims
Recorded Features	Not recorded
District	New York/Ivanpah
Period of Significance	Golden Years of Mining in MNP

IMPORTANT MINE SITE DATA

Gold Bronze Mine

AML PSI Number	261
State Trinomial	N/A
Geographic Location	USGS topographic quadrangle Ivanpah, Calif. T14N/R16E Section 3 UTM, Zone 11: Nad 83 659842 mE/3910810 mN
Previous Documentation	Storms 1892:367; Crawford 1894:232; Crawford 1896:321; Tucker and Sampson 1931:297; Wright et al. 1953:No.106
Mineral	Gold, silver, copper, lead
History	1894–1940 (intermittent); 7 claims
Recorded Features	Not recorded
District	Vanderbilt
Period of Significance	Golden Years of Mining in MNP

Golden Quail/Gold Chief

AML PSI Number	417
State Trinomial	N/A
Geographic Location	USGS topographic quadrangle Pinto Valley, Calif. T13N/R16E Section 18 UTM, Zone 11: Nad 83 654200 mE/3898076 mN
Previous Documentation	Wright et al. 1953:No.107
Mineral	Gold
History	Developed 1895–1915 (intermittent); 1960s
Recorded Features	Not recorded
District	Unknown
Period of Significance	Golden Years of Mining in MNP

IMPORTANT MINE SITE DATA

Hidden Hill[s]

AML PSI Number	688
State Trinomial	N/A
Geographic Location	USGS topographic quadrangle Van Winkle Spring, Calif. T8N/R14E Section 1, 6 UTM, Zone 11: Nad 83 632775 mE/3858118 mN
Previous Documentation	Cloudman, Huguenin, and Merrill 1919:801; Crawford 1896:323; Tucker and Sampson 1931:301; Wright et al. 1953:No.125
Mineral	Gold, silver
History	1882–1919 (intermittent)
Recorded Features	2 Windmill House Pads Windmill Windmill Well 2 Water Tank Corral 2 House Pads Well
District	Arrow/Arrowhead
Period of Significance	Golden Years of Mining in MNP

Ivanpah

AML PSI Number	13–20
State Trinomial	CA-SBR-2978H
Geographic Location	USGS topographic quadrangle Clark Mountain, Calif. T17N/R13E Section 9, 24 UTM, Zone 11: Nad 83 628285mE/3938100 mN
Previous Documentation	Chapman, Ozbun, and O'Brien 2004; Crawford 1894:376; Wright et al. 1953:No.318
Mineral	Silver
History	1869–1892; numerous claims
Recorded Features	Townsite and millsite discussed in Chapman, Ozbun, and O'Brien 2004
District	Ivanpah/Clark
Period of Significance	Silver Mining in MNP

IMPORTANT MINE SITE DATA

Leiser Ray (Exchequer/Vanadium Gold/Louisiana-California/California Comstock)

AML PSI Number	596
State Trinomial	N/A
Geographic Location	USGS topographic quadrangle Homer Mountain, Calif. T11N/R18E Section 16 UTM, Zone 11: Nad 83 679313mE/3877888 mN
Previous Documentation	Cloudman, Huguenin, and Merrill 1919:852; Tucker and Sampson 1931:369; Wright 1953:No.390
Mineral	Vanadium, tungsten, gold
History	1902-; 1911-; 1923-1924
Recorded Features	Can Dump 3 Millsites Trench 2 Ore Cart Dumps 3 Shafts Rock walls 5 Foundations Dugout Well
District	Signal
Period of Significance	Golden Years of Mining in MNP

IMPORTANT MINE SITE DATA

Mammoth Mine

AML PSI Number	3
State Trinomial	N/A
Geographic Location	USGS topographic quadrangle Pachalka Spring, Calif. T17N/R12E Section 14 UTM, Zone 11: Nad 83 620550 mE/3935804 mN
Previous Documentation	Hewett 1956
Mineral	Copper
History	1916–1929
Recorded Features	6 Rock Walls Foundation 3 Deadmen Cut 6 Trenches 10 Prospects Discovery Monument 9 Posts Rock Ruin Ore Chute 9 Adits 2 Stopes
District	Clark
Period of Significance	Golden Years of Mining in MNP

IMPORTANT MINE SITE DATA

Mojave Tungsten; Green Mine

AML PSI Number	54
State Trinomial	CA-SBR-4889/H
Geographic Location	USGS topographic quadrangle Clark Mountain, Calif. T17N/R13E Section 15 UTM, Zone 11: Nad 83 629780 mE/3935749mN
Previous Documentation	Cloudman, Huguenin, and Merrill 1919:839; Tucker and Sampson 1931:368; Tucker and Sampson 1943:504–505; Wright et al. 1953:No.370
Mineral	Tungsten
History	1915–1918; 11 claims
Recorded Features	Outhouse Rock Ruin Cabin Can Dump 8 Rock Walls Adit Prospect Pit
District	Clark
Period of Significance	Golden Years of Mining in MNP

New Era Mine

AML PSI Number	184–185
State Trinomial	N/A
Geographic Location	USGS topographic quadrangle Cima Dome, Calif. T15N/R14E Section 20, 29 UTM, Zone 11: Nad 83 635190 mE/3914389 mN
Previous Documentation	Cowie, Baird, and McWilliams 2005; Wright et al. 1953:75–76
Mineral	Gold
History	Prior to 1914
Recorded Features	Discussed in Cowie, Baird, and McWilliams 2005
District	Standard
Period of Significance	Golden Years of Mining in MNP

IMPORTANT MINE SITE DATA

New Trail Mine

AML PSI Number	163
State Trinomial	N/A
Geographic Location	USGS topographic quadrangle Mineral Hill, Calif. T15N/R14E Section 9 UTM, Zone 11: Nad 83 637700mE/3917652 mN
Previous Documentation	Wright 1953:65–66, 184
Mineral	Copper, gold, silver, magnesite
History	1870–; 1916–1919; early 1930s; 1947-1951
Recorded Features	4 Rock Walls Rock Ruin 2 Cabins Headframe Outhouse Double Garage Leach Tank (cinder) Leach Pad (concrete) Explosive Locker 4 Prospects
District	Bullion?
Period of Significance	Golden Years of Mining in MNP; Great Depression Mining in MNP

IMPORTANT MINE SITE DATA

Oro Fino Mine

AML PSI Number	356
State Trinomial	N/A
Geographic Location	USGS topographic quadrangle Seventeen Mile Point, Calif. T13N/R10E Section 23, 26 UTM, Zone 11: Nad 83 601093 mE/3895555 mN
Previous Documentation	Tucker and Sampson 1931:329; Tucker and Sampson 1943:457; Wright et al. 1953:77
Mineral	Gold, silver
History	1930–1945; 4 claims
Recorded Features	2 Houses Bunkhouse 3 Platforms Platform Area 2 Can Dumps 4 Declines Explosive Locker 2 Foundations 2 Mill Footings Headframe Hoist Platform 2 RR Trestles 28 Rock Walls 5 Trails 6 Roads Loading Platform Ore Chute Water Standpipe Veranda Forge Gate 2 Outhouses 2 Rock Ruins 2 Storage Sheds 12 Adits 7 Shafts 18 Trenches 21 Prospects 13 Posts
District	Rock Springs/Solo
Period of Significance	Great Depression Mining in MNP

IMPORTANT MINE SITE DATA

Paymaster (Whitney) Mine

AML PSI Number	353
State Trinomial	N/A
Geographic Location	USGS topographic quadrangle Seventeen Mile Point, Calif. T13N/R10E Section 23 UTM, Zone 11: Nad 83 600253mE/3895753 mN
Previous Documentation	Tucker and Sampson 1931:329–331; Wright et al. 1953:78
Mineral	Gold, silver
History	1900; 1909–1914; 1932–1944; 1952; 8 claims
Recorded Features	8 Adits Cut 9 Declines 5 Shafts 4 Trenches 42 Prospects 9 Road Segments 6 Trail Segments Waste rock 2 Discovery Monuments 22 Posts
District	Solo/Halloran Springs
Period of Significance	Golden Years of Mining in MNP; Great Depression Mining in MNP

Rex Mine

AML PSI Number	621
State Trinomial	CA-SBR-11275H
Geographic Location	USGS topographic quadrangle Fountain Peak, Calif. T10N/R13E Section 9 UTM, Zone 11: Nad 83 626532mE/3870808mN
Previous Documentation	Langan 2004; Wright et al. 1953:No.173
Mineral	Gold, silver
History	1934; 1948; 1952
Recorded Features	Discussed in Langan 2004
District	Kelso?
Period of Significance	Great Depression Mining in MNP

IMPORTANT MINE SITE DATA

Sagamore/New York Mine

AML PSI Number	300
State Trinomial	CA-SBR-3062H
Geographic Location	USGS topographic quadrangle Ivanpah, Calif. T14N/R16E Section 32 UTM, Zone 11: Nad 83 655990mE/3902822 mN
Previous Documentation	Aubury 1908:831-833; Cloudman, Huguenin, and Merrill 1919:790; Tucker and Sampson 1931:279; Tucker and Sampson 1943:437; Wright et al. 1953:67
Mineral	Silver, copper, lead, zinc, gold, tungsten (unsuccessful)
History	1870; 1890s; 1901; 1914-1920s; 1942-1945; 1952-; 32 claims
Recorded Features	2 Outhouses 5 Rock Ruins 2 Foundations Wood Building Explosive Locker Tin Storage Building Bunkhouse Addition Chimney Arrastra Bunkhouse 3 Rock Walls Ore Bin/Chute Trestle Headframe Headframe Footing Concrete Footing Adit Shaded Storage Locker Concrete Pad Can Dump
District	New York
Period of Significance	Silver Mining in MNP; Golden Years of Mining in MNP

IMPORTANT MINE SITE DATA

Silverado-Tungstite Mine

AML PSI Number	159
State Trinomial	CA-SBR-10943H
Geographic Location	USGS topographic quadrangle Mescal Range, Calif. T15N/R14E Section 18 UTM, Zone 11: Nad 83 634145 mE/3916989 mN
Previous Documentation	Cowie, Baird, and MacWilliams 2005; Wright et al. 1953:152
Mineral	Tungsten, silver
History	Before 1900 (?); Post 1952 (?)
Recorded Features	Discussed in Cowie, Baird, and MacWilliams 2005
District	Standard
Period of Significance	Mining in MNP during World War II and Beyond

Standard No. 1 & 2

AML PSI Number	173/190
State Trinomial	CA-SBR-10944H (# 1); CA-SBR-10941H (# 2)
Geographic Location	USGS topographic quadrangle Cima Dome, Calif. T15N/R14E Section 8, 19 UTM, Zone 11: Nad 83 633121 mE/3914227 mN (Standard No. 2)
Previous Documentation	Cloudman, Huguenin, and Merrill 1919: 790; Cowie, Baird, and MacWilliams 2005; Tucker and Sampson 1931:279–280; Wright et al. 1953:68
Mineral	Copper, gold, silver, tungsten
History	1902–1908; 1917–1919; 1934–1935
Recorded Features	Discussed in Cowie, Baird, and MacWilliams 2005
District	Standard
Period of Significance	Golden Years of Mining in MNP; Great Depression Mining in MNP

IMPORTANT MINE SITE DATA

Stonewall Mine (Beatrice, Monitor, Lizzie Bullock; Stonewall Jackson, Alpha, War)

AML PSI Number	21-25
State Trinomial	N/A
Geographic Location	USGS topographic quadrangle Clark Mountain, Calif. T17N/R13E Section 9 UTM, Zone 11: Nad 83 627725mE/3937767mN
Previous Documentation	Warren et al. 1980:216-217; Hewett 1956:7
Mineral	Silver
History	1870s-1890s
Recorded Features	9 Rock Ruins Rock Wall
District	Clark
Period of Significance	Silver Mining in MNP

Taylor Mine

AML PSI Number	27
State Trinomial	N/A
Geographic Location	USGS topographic quadrangle Clark Mountain, Calif. T17N/R13E Section 9 UTM, Zone 11: Nad 83 628370mE/3937454mN
Previous Documentation	Not known
Mineral	Silver, gold, copper (?)
History	1870s-1890s
Recorded Features	14 Adits Agave Roasting Pit 5 Shafts 3 Stopes Trench 3 Prospects Post
District	Clark
Period of Significance	Silver Mining in MNP

IMPORTANT MINE SITE DATA

Telegraph Mine

AML PSI Number	121
State Trinomial	CA-SBR-4554H
Geographic Location	USGS topographic quadrangle Solomon's Knob, Calif. T15N/R11E Section 17 UTM, Zone 11: Nad 83 606166mE/3916087 mN
Previous Documentation	Hewett 1956:120; Tucker and Sampson 1931:322; Tucker and Sampson 1943:462-463; Wright et al. 1953:82
Mineral	Gold, silver, copper
History	1932-1942; 1946-1948
Recorded Features	2 Declines 3 Shafts 7 Trenches 8 Prospects
District	Solo/Halloran Springs
Period of Significance	Great Depression Mining in MNP

Tramway Mine

AML PSI Number	435
State Trinomial	N/A
Geographic Location	USGS topographic quadrangle Columbia Mountain, Calif. T12N/R14E Section 33 UTM, Zone 11: Nad 83 637166 mE/ 3883407 mN
Previous Documentation	N/A
Mineral	Unknown
History	Unknown
Recorded Features	Shed Foundation Ore chute 3 Shafts
District	Unknown
Period of Significance	Unknown

IMPORTANT MINE SITE DATA

Vanderbilt Mines

AML PSI Number	258
State Trinomial	N/A
Geographic Location	USGS topographic quadrangle Ivanpah, Calif. T14N/R16E Section 4 UTM, Zone 11: Nad 83 657895mE/3910930mN
Previous Documentation	Cloudman, Huguenin, and Merrill 1919:816; Crawford 1894:235; Crawford 1896:329; Storms 1893:367; Tucker and Sampson 1931:317; Tucker and Sampson 1943:464; Wright et al. 1953:82–83
Mineral	Gold, silver, copper, lead
History	1890s; 1914–1941 (intermittent); 38 claims— Gold Bar and Gold Bronze veins
Recorded Features	Not recorded
District	Vanderbilt
Period of Significance	Golden Years of Mining in MNP; Great Depression Mining in MNP

Vanderbilt Mines

AML PSI Number	258
State Trinomial	N/A
Geographic Location	USGS topographic quadrangle Ivanpah, Calif. T14N/R16E Section 4 UTM, Zone 11: Nad 83 657895mE/3910930mN
Previous Documentation	Cloudman, Huguenin, and Merrill 1919:816; Crawford 1894:235; Crawford 1896:329; Storms 1893:367; Tucker and Sampson 1931:317; Tucker and Sampson 1943:464; Wright et al. 1953:82–83
Mineral	Gold, silver, copper, lead
History	1890s; 1914–1941 (intermittent); 38 claims— Gold Bar and Gold Bronze veins
Recorded Features	Not recorded
District	Vanderbilt
Period of Significance	Golden Years of Mining in MNP; Great Depression Mining in MNP

IMPORTANT MINE SITE DATA

Von Trigger/California Mine

AML PSI Number	593
State Trinomial	N/A
Geographic Location	USGS topographic quadrangle Hackberry Mountain, Calif. T11N/R17E Section 2, 10, 11, 15 UTM, Zone 11: Nad 83 670736 mE/3879603 mN
Previous Documentation	Cloudman, Huguenin, and Merrill 1919:785; Tucker and Sampson 1931:267; Tucker and Sampson 1943:438; Wright et al. 1953:68–69
Mineral	Copper, gold
History	1890s; 1907–1913; 1926–1929; 1944–1945
Recorded Features	Ore Bin Retaining Tank Millsite Drainage pad Shaft Post 4 Foundations Bridge Can Dump
District	Signal
Period of Significance	Golden Years of Mining in MNP; Depression Mining in MNP

Vulcan Iron Mine

AML PSI Number	629
State Trinomial	CA-SBR-3065H
Geographic Location	USGS topographic quadrangle Fountain Peak, Calif. T10N/R13E Section 25 UTM, Zone 11: Nad 83 630920mE/3865508mN
Previous Documentation	Lamey 1948; Wright et al. 1953:100
Mineral	Iron
History	1942–1948; Open-pit
Recorded Features	4 Trenches Drill Hole 14 Roads 10 Posts Survey Monument
District	N/A
Period of Significance	Mining in MNP during World War II

IMPORTANT MINE SITE DATA

Vulture Mine

AML PSI Number	73
State Trinomial	N/A
Geographic Location	USGS topographic quadrangle Pachalka Springs, Calif. T17N/R13E Section 36 UTM, Zone 11: Nad 83 624144 mE/3931786 mN
Previous Documentation	Cloudman, Huguenin, and Merrill 1919:816; Tucker and Sampson 1931:270; Wright 1953:No.57
Mineral	Copper, silver, lead, zinc
History	1915–1919
Recorded Features	Can Dump 9 Rock Walls Rock Alignment 2 Roads 2 Foundations Loading Platform Building Platform Chicken Coop 4 Concrete Pads Headframe Well? 11 Rock Ruins Adit Decline Shaft Prospect
District	Bullion
Period of Significance	Golden Years of Mining in MNP

Appendix C






Mojave National Preserve Mining Sites Map and Data Tables



Instructions for Mojave Mines ArcMap Project


Appendix C contains (1) a personal geodatabase file named MOJA Mining Resources, and (2) a geodatabase file named Topographic Map. Contained within MOJA Mining Resources are geospatial data consisting of a boundary file of the Preserve, point locations for 461 mining and mining-related sites located within the Preserve (provided by David Moore, GIS Specialist), and a related table detailing features at sites visited and documented by Weasma and Gordon Pine (lands coordinator/geologist). The Topographic Map geodatabase file contains a mosaic image of the corresponding USGS 7.5-minute topographic quadrangles and index covering the Preserve area. The geodatabase is enhanced from a table adapted from data compiled by Weasma (2005b, 2007). The database provides mine name, identification numbers, and location, as well as, if known, claimant information, mineral sought, years of operations, and district affiliation. Any available claimant information is provided in a separate database also adapted from Weasma (2005a).

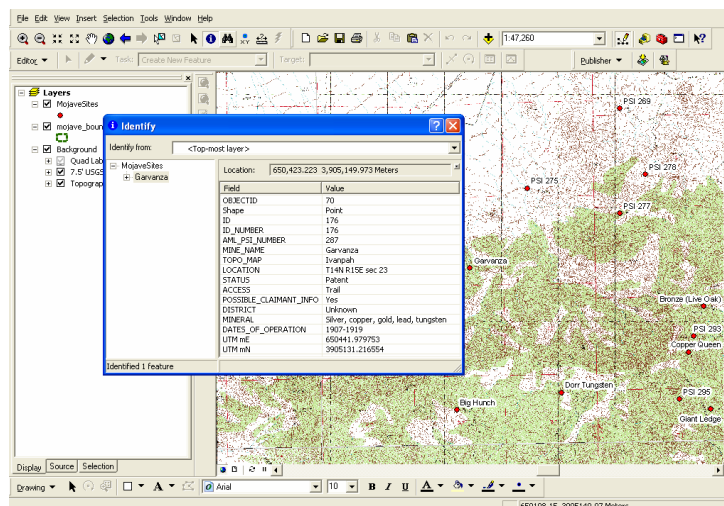
The program is designed to be used with ArcMap 9.2 or higher. All of the tables in this ArcMap project can also be opened in Microsoft Access.

Open program file. The Mojave National Preserve will be shown with mine locations in red, the Preserve boundary in green, and topographic quadrangle information in blue. These items are shown on the map on the right side of the screen and lists in the table of contents window on the left side. The images can be turned on or off by checking or un-checking the desired box. The display and source tabs are located at the bottom of this window.

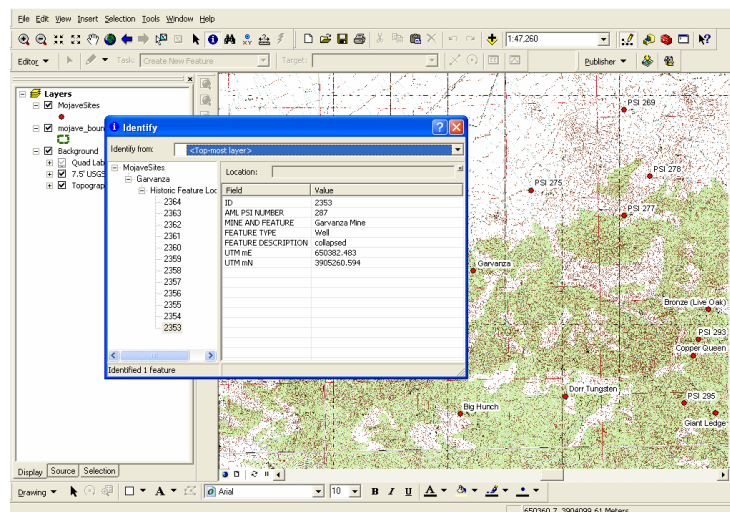
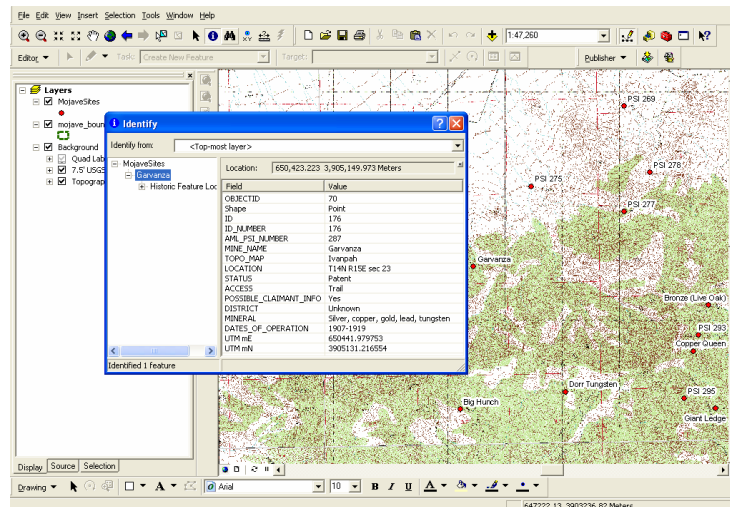
To zoom into an area use the  key or the  key. To zoom out use the  key or the  key. To pan the map, use the  key.


To find a specific mine site by name click the  key. The find window will appear. In the "Find:" prompt box, type the name of the mine. The mine name will appear in the window below. Right click the mine name to " Zoom to" the location.

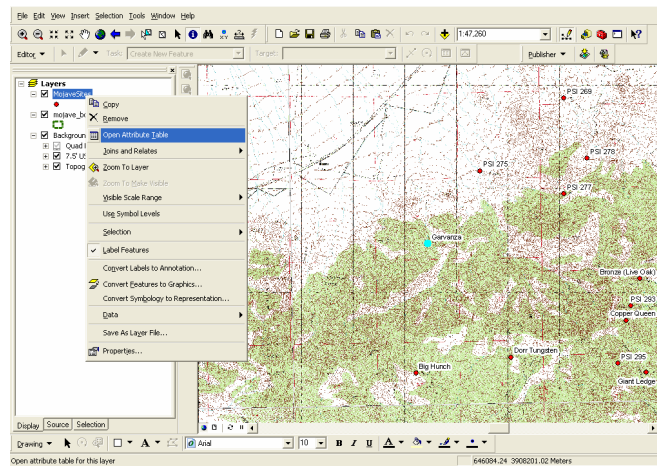
Navigate to a selected mine or general area. For more information on a particular mine site use the  key. The identify results window will appear detailing mine identification number, mine PSI number, mine name, location, status, access, available claimant information, known district, mineral, dates of operation, and UTM coordinates.



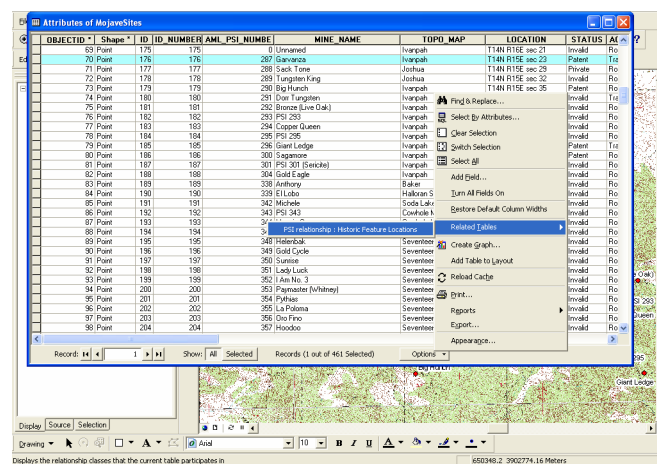
A plus symbol next to the mine name on the left side of the Identify results window indicates that specific feature information is available on that mine. Click the plus symbol and a list of features identified by number will appear. Click on each number to view the available data, including feature type, comments, and UTM coordinates.



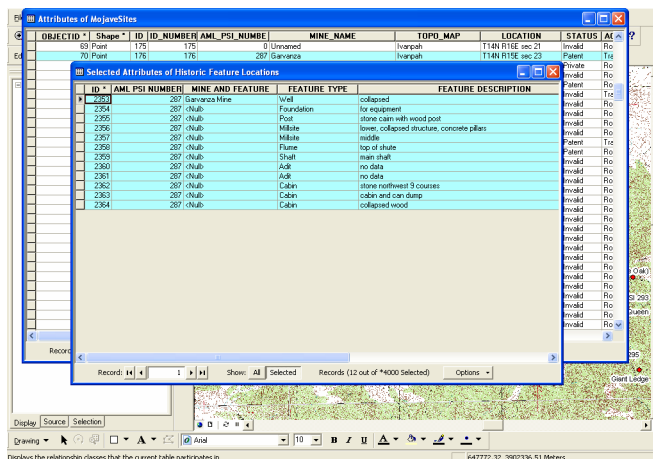
A second option to access information about a particular mine is to click the  key and type the mine name. As before the results will appear in the window below. Right click the mine name and choose "Select." The mine will now appear highlighted on the map and will be selected in the attribute table. To open the attribute table, right click on MojaveSites in the table of contents on the left side of the screen and select "Open Attribute Table."



The attribute window will open with information on all 461 mine sites. Scroll down to find the selected choice (also highlighted). With mine selected, click the Options button at the bottom of the attribute window. Select "Related Tables > PSI relationship : Historic Feature Locations."

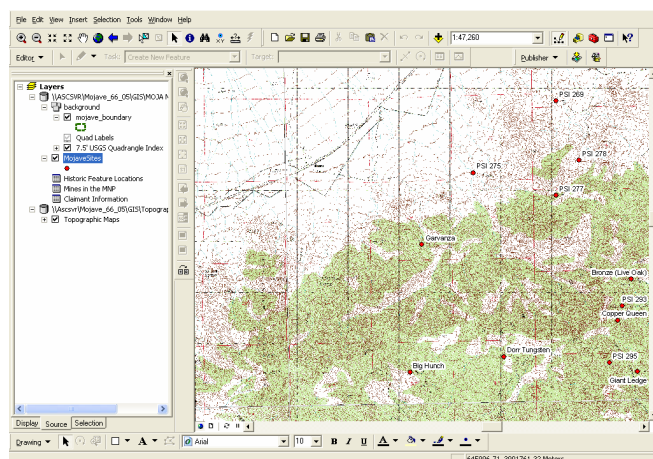


A new attribute table will display any features recorded at the mine. Not all mine locations have been documented and recorded. To view features related to the chosen mine chose Selected at the bottom of the new attribute window.



This project also contains two additional tables. "Mines in the MNP" contains information on all known mining locations in the Preserve; 169 sites have not been mapped and will only be listed on Mines in the MNP and not in MojaveSites. "Claimant Information" contains data compiled by Ted Weasma, MNP geologist.

To access these additional tables, choose the Source tab at the bottom of the table of contents window. The tables will be listed. Right click the table and choose open.



To search within these tables select the Options tab at the bottom of the attribute table and choose Find. Enter criteria in display box.

